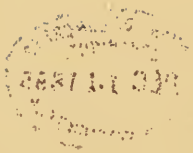

PRIZE ESSAYS ON SPINNING,

AS THEY APPEARED IN THE

WOOL AND COTTON REPORTER.

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INTRODUCTION.

These essays on cotton spinning were written in competition for prizes offered by the Wool and Cotton Reporter in 1890. *They are, by the decision of the judges, the prize-winners in the series of twenty essays written by the several contestants, and published from week to week in the columns of the Wool and Cotton Reporter from Sept.* 11, 1890, *to Feb.* 25, 1892.

Two first prizes, one second and one third prize, were awarded as follows: Essay No. 5, *first prize, a solid gold Waltham watch, Geo. H. Edick, Dundas, Ont.; essay No.* 6, *first prize, a solid gold Waltham watch, Samuel Rowcroft, Kingston, Ont.; essay No.* 12, *second prize, a gold-filled Waltham watch, William Whittam, Jr., Westerly, R. I.; essay No.* 16, *third prize, a solid silver Waltham watch, John B. Cudlip, Fall River, Mass.*

The judges appointed to examine the essays were Mr. Walter E. Parker, agent of the Pacific Mills, Lawrence, Mass.; Mr. A. M. Goodale, agent of the Boston Mfg. Co., Waltham, Mass.; and Mr. A. E. Adams, agent of the Whitinsville Cotton Mills, Whitinsville, Mass.

The exclusive right to publish these prize essays was purchased by the Whitinsville Spinning Ring Company, of Whitinsville, Mass., by whom they are now issued.

GEORGE H. EDICK.

GEORGE H. EDICK,

OF DUNDAS, ONT.

The earliest years of Mr. Edick's life were spent at the pretty village of Chadwick's Mills, a very quiet and rural spot, whose only plea for existence lay in possessing the neatest little cotton mill that could be found anywhere along the Mohawk Valley. Here he was born in 1857, and resided until he was ten years old, when he received his first impressions of mill life, which, by the way, were somewhat vague, as his father, being then foreman, preferred to keep him at school. In 1867 his father moved to Canada and settled in Merritton, where he went to help start up a new (Lybster) mill. He was put to school again, but soon grew tired of this, and frequent visits to the mill interested him so much that he asked his father to give him a job. He did not prevail. Not willing to be put off, he attacked the manager, with the result that it was decided he should start as back boy. From back boy he came to be assistant on the spinning frames. In 1872 the Edick family moved back to the States again, and he went to work in the card room.

A better position being offered his father at Dundas, Ont., he returned once more to Canada, where he was given the position of second hand of spinning frames and filled it several years.

When about seventeen, this work began to grow irksome, and he concluded to seek some other vocation, and began to fit himself for the medical profession and entered McGill University in 1878. The money in large

part he earned by running a pair of mules, which he had learned to handle in the meantime. He worked summers and schooled it winters, and finally graduated in 1883.

Two years previous to this the cotton boom in Canada had assumed great proportions, and mills were budding forth all over the country. Soon Hamilton, Ont., was seized with the excitement, and ere long the Hamilton Cotton Mills was a thing of life and power.

He was given the position of second hand on mules and frames. He left this situation to finish his college course, and began the practice of medicine in 1883, which he continued to follow for two years, when his health gave out, and he was forced to abandon all work for a year. At the end of this period he had used up all the capital he possessed and some that he did not possess, as he had a family to maintain. Not feeling able to resume practice again, he re-entered the Hamilton Cotton Mills as second hand in his former place. From here he went to assist in starting the new Des Moines Cotton Mill, Des Moines, Ia.

After an absence of four months he returned to Hamilton, where he had the good fortune to secure his former position. In a short time his services were sought by the Brantford Cotton Mills in a similar capacity. From here he was transferred to a larger sphere of the company's (Dominion Cotton Company's) operations in Montreal, Quebec.

His health being restored, he resumed the practice of his profession in Detroit, Mich., in 1892, where he now resides, and when opportunity offers still enjoys reading cotton chats and dreamily reviewing the scenes of years long since gone by.

PRIZE ESSAY ON SPINNING,

NO. 5.

BY GEORGE H. EDICK.

CHAPTER I.

This contest, which the generosity of the publisher has called forth, merits the appreciation and encouragement of all lovers of progress in cotton manufacturing. It should prove a valuable aid and incentive to a higher ambition among those for whose especial purpose it has been designed, while to those who enter the arena the reward of action, if not of merit, will more than compensate for the labor given.

In response to this cordial invitation extended to spinners by the publisher to participate by contributing an article on the above subject, I will attempt to present to my brother co-laborers and other readers of the *American Reporter*, who may be interested in the matter, the causes and the remedies of various troubles continually arising during the process of spinning. In pursuance of this object, I have classified and arranged the imperfections generally encountered in the spinning room according to the distinguishing features observed in the yarn. While this division or arrangement is quite arbitrary, I believe it will commend itself to all readers, and I trust prove itself intelligible as well as practicable.

I shall take up the subject under the following classification, viz.: Uneven yarn, cut yarn, raw, ragged, and tender yarn, curled, cockled, or knotty yarn, slack twisted yarn, kinky yarn, harsh or wiry yarn, overstrained yarn, ciliated,

fuzzy, or hairy yarn, dirty yarn, badly wound yarn, and lastly, a few general remarks.

In beginning our investigation, we will look first into the spinning room, where are to be found both ring and throstle frames. Afterward we shall review the subject in the mule room. To embrace both departments in the same effort, we would be compelled to travel back and forth pretty often, and would soon become fatigued and perhaps confused, and the matter under consideration would seem disjointed and lacking in interest, so that, at the risk of repeating some things, I shall refer to each room separately.

Uneven yarns: Uneven yarn is the greatest evil in cotton manufacturing. To combat this and remove it as far as possible has been the object and aim of inventors and artisans from almost the very inception of the spinning industry.

As to the causes of uneven yarn, in order to avoid giving undue length to this essay I have omitted to offer a remedy in a large number of instances wherein I have referred to causes which produce bad work in the spinning room. But it is only in cases where, from the nature of the cause operating, there can be no mistaking the proper remedy. But let us look for a few moments at some of the causes still operating to produce uneven yarn. We have (1) the condition and method of operating the leather rolls. Where the bosses of the same leather rollers, whether tight or loose, are not of the same diameter, a smooth, round, even thread cannot be spun; some of the fibres will slip through without being drawn evenly, due to variation in the surface contact with the fluted roll, together with an uneven bearing surface of the entire length of each boss on the fluted roll. The unequal diameter of the bosses of the same roll, if tight, causes the leather to become chafed and rough from different surface speed, and if a damp and cool atmosphere or a very dry one is present, the fibres will lick up and lap around more on this account.

Shell rolls would help this defect very materially, especially in mills where temperature and humidity cannot be regulated satisfactorily, which is a pretty general thing as yet. (2.) Deficient rotundity of the latter roll at the place where the lap occurs, preventing an even drawing of the fibres at that point, and causing a thin place to appear in the yarn. (3.) Flannels remaining on too long and becoming dry and hard, or separating where united, so that the leather fails to accommodate itself to the fluted roll and does not get a firm grip on the fibres. The bad results arising from the former are more readily seen on fine work. A hard roll is preferable on coarse work. (4.) Tight fitting leather rolls in respect to lateral movement, also too much backward and forward play due to the setting of leather roll directly over the centre of the steel roll. (5.) A loose leather roll or a grooved one made so by hard roving or through keeping the weights on them when the mill shuts down for several days. (6.) Roving guides becoming partially filled with waste, and stretching the roving and disturbing the parallelism of the fibres. (7.) Where revolving top clearers are in use on frames which have only the front roll weighted, more or less interruption of their smooth, steady motion is observed as waste gathers on them. This irregular movement gives a backward and forward action to the middle roll and is caused by inequalities on the surface of the clearer, and equals in number those observed on the clearer. The wider the rolls — top ones — are separated, the more general will this be throughout the frame, as the clearer settles down further between the rolls. If the middle roll could be made to turn the clearer, this trouble would disappear. (8.) Bad fitting and ill-balanced bobbins on frames. (9.) A lap on one of the bosses of a leather roll while the other ends are running. (10.) Rollers put in with the lap running the wrong way,— a very general thing among some careless frame spinners when taking a roll out to remove the lap. (11.) Rolls running out of

square with the fluted roll; that is, one boss a little ahead of another. (12.) In using the space behind the nibs of cap-bars as a gauge in setting the top rolls. This part of cap-bars does not receive the attention it deserves. There is a want of exactness in manufacture here that should not exist, as well as in the ends of the leather rolls, which are not always, I am sorry to say, concentric with the body of the roll. A better way of setting the rolls is to place a wedge between the back and middle roll to keep the middle roll where it will be when running. Then take a gauge and place between each boss of front roll and the middle roll. This will allow for any variation in the diameter of the leather rolls or want of exactness in the cap-bars. If this method should produce the effect stated under 11, it must be tolerated as the lesser of two evils. (13.) Hard turning rolls from lack of oil and accumulations of waste, and dirt burnt on the arbors of shell rolls; also the flutes of steel rolls obliterated in places from impacted waste and dirt. (14.) Long piecings made when putting in a full roving, as it lifts up the boss of the leather roll and allows fibres to be drawn unevenly on the threads of that roll. (15.) Too slow speed on ring frames requiring a heavy traveler to secure proper tension, which, although not injuring the yarn on the large part of the bobbin, renders it uneven when winding on the small diameter. In the former case, tension may not be sufficient. In the latter it is excessive.

A better way would be to increase the speed and use a lighter traveler. In following this idea up do not run your frame to death, as there are other parts concerned in the making of the thread. If over seventy-five per cent of the breakages of ends occurs at the smallest diameter of the yarn or bobbin, you may be pretty sure a lighter traveler and higher speed will give more satisfactory results. (16.) Where two rovings of different sizes are placed together to spin one thread, there will be more or less unequal draught from different degrees of pressure

exerted. If they are of different color, the effect is very apparent in the yarn and cloth. If one should be several times larger than the other, the smaller one may sometimes come through without any draught, if uneven or much twist be present. Even roving, slack twisted as possible, good top rolls, and set wider than the steel rolls and gauged for the coarser roving, will help the difficulty. Do not fall into the error of separating the rolls too far here to overcome this obstacle. (17.) Gathering of waste around the top of the skewer from roving ends, which are allowed to hang down over the creel when the roving boy lays them up, or skewers binding in the creel from want of proper space between the tiers. (18.) Uneven roving spun on frames makes worse yarn than when run on mules. In these cases make draught as light as possible, or reduce the speed if too high. (19.) And lastly, in this connection, a most prolific source of uneven yarn is found in improper adjustment and weighting of the rolls. If set too close, the fibres are either overstrained or broken, and if set too far apart, short fibres, many of them, fall out or lap around the middle roll, thus weakening the thread, and in both cases the draught is uneven.

Further remarks on uneven yarn, which might be brought forward at this time, together with some directions for setting the rolls, will be deferred until we come to speak of the mule room. Numerous defects to be mentioned hereafter might be classed under uneven yarn, but I have thought best to give them a separate name.

CHAPTER II.

Cut yarn: (1.) Too much play in the joints of steel rollers. (2.) Crooked journals of the same. (3.) On the throstle frame when spinning fine numbers, if there is too much tension between the flier and the bite of the roll

when the bobbins become well filled and the flannel washers and bobbins are not in good order, cut yarn will result when the frame starts up. This, more so, if the concavity of the bobbin at the bottom is very slight, as then the friction is increased. If to these there be added a large bore in the bobbin, the result is more clearly seen. (4.) Pinion gear set too deep or not deep enough. About 4-5 will be found a good working distance, and less in some cases, on change gears. (5.) In changing pinions, neglecting to turn the back roller one tooth forward, to avoid the possibility of cutting the yarn. (6.) On filling frames, or where a small bobbin is in use, stopping the frame when the ring rail is at the top of the chase, causing a pull of the yarn very nearly at right angles to the run of the traveler when starting again. The heavier the traveler, or less twist in the yarn, as in filling, the greater the evil.

Raw, ragged or tender yarn: This description of yarn is produced: (1.) By using too heavy a traveler, or from excessive strain at some point. (2.) A worn ring or a loose one. (3.) A worn traveler. (4.) Guide wire out of line or badly worn at the bearing surface. (5.) Strained, raw or lumpy roving, or roving with soft and thick places. (6.) Raw cotton burnt in the bleaching or dyeing. (7.) Very uneven roving, or roving below the standard number. (8.) Coarse and fine fibres; if the difference is great, worked together. (9.) Too great a variation in the length of the staple, especially when the short fibres are over numerous. (10.) Too great a proportion of immature and poorly developed fibres. (11.) Too much waste. (12.) Cut roving. (13.) Rolls set too close, cutting or breaking the fibres, or too far apart. (14.) Too much twist.

Cockled, curled, or knotty yarn: (1.) Faulty adjustment of the saddles, stirrups, etc., whereby they do not ride squarely on the roller, but impinge more or less at the sides, especially when there are half a dozen or so pieces,

comprising the "set," used in giving weight to the rollers. A disarrangement in these "fixings," coupled with a rather light weight, often causes a hitch in the drawing of some of the fibres, and thus produces knots, or bunches, or "cockles," in the yarn. (2.) Too close position of the front and middle roll. (3.) Loose leather rolls. (4.) Too long a staple. (5.) Anything that temporarily arrests the drawing of all the fibres, or a portion of them, such as a piece of thread waste that may have worked into the roving, or a piece of fibre which the card neglected or failed to remove. Oftentimes, where the roving draws hard or the staple is very irregular, or where the roving is very uneven or hard twisted or damp, or where sufficient weight cannot be applied to the rolls, or where the rolls are set too close, the practice of running the small saddle with the highest part over the back roller is resorted to. This may prove more or less effective, but gives uneven yarn from irregular draught of the fibres, and is not recommended. Such a position may sometimes remove the cockles from the yarn; but the short end or highest part of the saddle should be over the middle roll, to secure a smooth, even, and finished appearance to the thread. Very possibly this view may not coincide with the practice of some spinners. If not, the cause will be found in the direction spoken of.

A milder form of this trouble, but without any arrest of the drawing of fibres, may be aptly termed contracted yarn, caused by (1) leather rolls with very uneven surfaces; (2) too light a traveler; (3) slow speed; (4) too much twist; (5) on throstle a lack of tension on the yarn.

Slack twisted yarn: Twist is one of the most important factors in the production of yarn, and upon its constancy and regularity will depend very largely the success achieved in any mill. (1.) Much variation in twist will give rise to serious trouble in subsequent processes, and become a fruitful source of much poor cloth in respect to color, strength and finish. (2.) Where dyed cotton is spun, or

doubled, or different shades of roving are run together, a variation in the amount of twist is readily seen in the cloth and makes it difficult, if not impossible, to finish pieces alike. (3.) Spindle steps should receive careful attention in respect to cleaning and oiling, as lack of system on this point will show up in weak yarn, particularly with the Rabbeth form of spindle. (4.) Uneven tension of the spindle bands or slack bands producing yarn of different diameter, strength, smoothness, and lustre. Bands can now be purchased which, when applied to the spindles, are of the same tension, — an important advantage. Numerous devices have been put on the market claiming to overcome all the evils of variable twist. But so far as my observation extends, they are not entirely satisfactory. (5.) Difference in the diameter of spindle bands, by varying the amount of twist, and quadrant set too far back. (6.) Insufficient curve given to the finger attached at the bottom of the locking bar or arm of the faller, which should allow the faller to unlock a little later each stretch. (7.) Bands having an accumulation of waste making them thicker than normal. (8.) Whorls of varying diameters. (9.) In frames with a traversing bolster rail, the latter sometimes gets out of line, or becomes warped and bears on the spindle. (10.) Brasses in the bolster rail on throstle frames not set perfectly square, throwing spindle out of perpendicular. (11.) Waste gathering around the spindle at points which are close to the fixed portions of the frame, such as bolster, wire hook, over whorl, etc. (12.) Carelessness when piecing up ends, in not fastening the bobbin on the spindle. (13.) Waste accumulating in bobbins and preventing proper adhesion. (14.) Alterations in twist due to the action of the weather on the spindle bands. (15.) In spinning very coarse filling on ring frames, say below 5s, where the double tin cylinder is in use, if the ends appear to go worse on the side corresponding to the cylinder receiving its motion direct from the belt and no

assignable reason can be found, it might be well to remember that there is less twist in the yarn on that side, owing to the spindles being driven from a cylinder which is itself turned frictionally. (16.) Where the same yarn is spun with filling bobbins and common warp bobbins, although on different frames, if these frames are geared up alike, making no allowance for loss of twist on the smaller bobbin. Variation in turns of twist at the small part of the bobbin is greater than that due simply to less diameter of bobbin. There is the increased strain to recollect, giving more length of yarn to be wound on in the same time, and so less twist per inch.

CHAPTER III.

Kinky yarn caused by: (1.) Slow speed and rather light traveler, especially if yarn is uneven or dirty, that is, containing motes, seeds, etc., etc. (2.) Guide wire becoming worn, and catching the thread under condition of 1. (3.) Waste on traveler will do the same. (4.) Bobbins on ring frames worn rough at the top, catching the thread and holding it. (5.) On throstles, poor washers, as friction or dirt in the legs of the flier; too much twist; too little drag on bobbin; wide bore bobbin; too many laps on flier. These kinks formed by the above conditions frequently pass on into the yarn on the bobbin. Again, winding is completely arrested, and the thread snarls and lashes adjoining ends, breaking them down.

Harsh or wiry yarn: (1.) Yarn spun from cotton that has not been very well mixed or thoroughly opened. (2.) Insufficiency of doublings, particularly if with 1. In other words, cotton that has not been worked enough in card room. The coarser and harsher the fibre the more noticeable. (3.) In mills where the dyeing of raw cotton is practised, and the latter is then sent to the opener un-

washed, or superfluous dyestuffs left on from overloading the fibres, rough, harsh, and wiry yarn will be the consequence. (4.) Too much twist, and more so if the yarn is very uneven. (5.) Neglect of spinners to pull off a double thread when one end runs into another. (6.) Roving coarser than the standard.

Overstrained yarn: (1.) Elasticity is one of the most desirable and necessary features in yarn. If it is insufficient for the special purpose desired, or too greatly removed in the process of spinning, the quality of the yarn and cloth is very much deteriorated. The amount varies from three to ten or twelve per cent, according to the quantity of twist and number of the yarn. Don't remove this elasticity by using too heavy a traveler. If one is used, more twist will be necessary, and the variation in number from the large to the small part of the bobbin is greater, and the twist will be less regular. Err on the side of a light traveler. (2.) Worn or bad fitting travelers, that is, those not adapted to the style or shape of the ring. (3.) Loose or worn rings or those of uneven friction surfaces. (4.) Stopping frame when ring rail is at the top of the chase, particularly on small bobbins. (5.) Worn guide wires, or guide wires out of alignment with the spindle. Guide wires should be set so as to have the bearing of the thread come directly over the top of the spindle and kept straight, as they often get slightly turned, and obstruct the free transmission of twist, causing more strain of yarn at the bite of the roll. (6.) In starting new frames, travelers run heavy and give uneven tension, and cause more breakages in consequence of the rings being unpolished. Burnished rings can now be supplied, thus doing away with this disagreeable and annoying feature in spinning, and so destructive to good work at a time when such is most desirable. (7.) Rings not set square on the ring rail. (8.) Ring rail not level. (9.) The pin at the top of the lifting rods, which maintains concentricity of

spindle to the ring, is apt to get broken off unnoticed, allowing the ring rail, and consequently the rings, to assume a variable position in relation to the spindle. (10.) Guide board out of its original position. (11.) Waste on traveler. (12.) Bent or broken fliers on throstle frames and bobbins chipped at the bottom, or torn flannel used as washers, or too many laps around the flier, or too few. (13.) Unsteadiness in the revolution of the spindle or bobbin.

Ciliated, fuzzy, or hairy yarn: (1.) Want of parallelism in the fibres of the roving. (2.) Insufficient twist to incorporate the fibres into the body of the thread. (3.) Too close or too wide setting of the rolls. (4.) Too many short or immature fibres in the stock. (5.) Poor grading and mixing of the stock. (6.) Running top roll with rough end of the lap against the roving. (7.) Too small a front roll, and a necessarily heavier weight, joined with high speed, causing the fibres to curl up. (8.) Ends whipping together, or striking against separators. (9.) A large ring, by forcing the thread through a greater area, causing increased centrifugal action, thereby throwing the fibres out on the surface of the thread. (10.) Too much draught by disturbing the close opposition of the fibres in the roving. (11.) Too high speed intensifies the evils present in the foregoing. (12.) Vibration of spindle or bobbin.

Dirty yarn (1) generally results from roving of a similar character, together with lack of cleanliness in handling. Clearer waste and flyings from broken ends getting twisted on the roving, together with seed, leaf, motes, etc., that were not removed in the card room. (2.) Too much oil on the rolls. (3.) Permitting waste to collect on both top and bottom clearers and rolls, so as to catch on the thread. (4.) When cleaning roller beam, letting waste come in contact with the thread. (5.) Piecing up an end before you have entirely removed the lap on the roller. If such yarn is plied or doubled it will not give satisfaction, as the twist will not run in regularly, and the yarn will

look rough and spongy, or open in places where the foreign matter is contained.

Badly wound yarn: (1.) Neglecting to change the wind or speed of traverse motion when changing several numbers coarser or finer, piling up the yarn too much in one place, making soft bobbins and less length of yarn on them, in the other, the frequent crossing of the thread filling up the ring. The most satisfactory wind for warp is where the layers lie as close together as possible upon the first rise of the ring rail after doffing. as the chase lengthens somewhat as the set fills up. (2.) On frames where the ring rail or bolster rail fails to travel, and this condition is observed to be general over the whole frame, look to copping motion, or the gear operating it; if local, the shifting rods are probably at fault. Waste collects in the bearing of these rods, and requires frequent removal to secure a free movement, otherwise much annoyance is experienced by having a number of spoiled bobbins continually meeting the eye. There is an excellent little device on the market for keeping the lifting rods clean. (3.) Bobbins working loose, permitting the yarn to run under, or from waste inside, forcing the bobbin upwards on the spindle. (4.) Bobbins on spindles not in the centre of the ring rub on one side of the ring when full size and loosen the yarn. (5.) On ring frames where the driving belt slips, soft wound bobbins will be made in consequence of a reduction in the speed of the traveler, giving it less friction or relative weight, together with less friction of the yarn on account of its slower passage through the traveler. (6.) The wind on throstle frames sometimes occasions much trouble through the traverse not being properly set. Bobbins may fill up too quickly at the top or bottom or at both points. If they fill up at both top and bottom, the fault lies in the position of the stud bearing on the heart wheel, being set too close to the fixed end of the lever. If, at the top or bottom, and only on one side, it can be remedied by adjust-

ing the bolster rail at the various places designed for that purpose. If bobbins run over at top or bottom, but only here and there one, you must add or remove washers accordingly, or perhaps you can adjust the spindle step to remedy the matter. (7.) On ring frames where there is no gauge for setting the bobbin on the spindle, and its position thereon depends upon the size of its bore, which, by use, becomes larger, there will be found, on looking over the tops of the bobbins when on the spindles, some one fourth to one half inch lower than others. This presents a very irritating spectacle to a spinner who has a good eye to symmetrical work. Besides, less yarn can be put on the bobbins, and the tension of the yarn will vary with the size of the bobbin. (8.) Waste gathering under the washers, raising the bobbin too high; or it may be too low from the bobbin being worn flat at bottom, or washer worn out. (9.) Slack bands.

CHAPTER IV.

What I have to say in regard to imperfections in yarn, traceable to some defect at the drawing rollers, or in the roving, is applicable to every type of spinning machine, so that if I mention some things now for the first time, their bearing upon other spinning frames will be implied.

Uneven yarn: The greater part of all the uneven yarn made can be located right at the drawing rollers. (1.) Difference in friction of the leather roll, from unequal weight on the levers, or from laps around the back and middle steel roller, and even leather rollers. (2.) Saddles not riding perfectly square, but impinging more or less at the sides on the rolls. (3.) Stirrups bearing on either front or middle roller (steel) or attached to the saddle improperly, throwing saddles out of right position. (4.) Changing from coarse yarn to fine, without change of top rolls, and maintaining the same weight on rollers in spin-

ning 10s as in spinning 28s ; keeping front and middle roll same distance apart, also regardless of size of roving, speed, or draught. (5.) Increased friction of skewer from its bottom and step being worn. (6.) Mule running out of square, stretching some threads when the mule strikes out and in, as well as cutting some when it strikes in too soon, at one end. This also varies the number, by putting more twist in less length of yarn at some places. On one of our American mules, these evils cannot occur, as the carriage is controlled by a positive motion and no vibration of it is possible. When once set square it remains so. The nice adjustment of this mule makes it specially adapted to high speed and good work. (7). Too much twist as carriage is coming out, on mules where head twist is used. Seventy-five per cent is about the average amount to put in to allow of regular drawing, but circumstances must be the determining factors as to whether less or more would improve the quality of the yarn. (8.) Too much "drag" or "gain" of the carriage. If the whole amount of the twist is put in, some of the fibres will be broken. If head twist is used many ends will fall down, and yarn be filled with thin and thick places. (9.) Damp roving. (10.) Stock not properly mixed. (11.) Using too low a grade of cotton for the class of goods manufactured. Unevenness and lack of strength result from too much draught for the coarse, short fibres. (12.) Uneven roving, however caused. The yarn made from this kind of roving, if above 20s, is improved on mules, and particularly where the "jacking" motion is used. Otherwise, any defect in the roving results in a similar state of the yarn. If doubled or plied, the unevenness is lessened. The remedy for uneven yarn or roving is, less gain of carriage except where the "jacking" motion is used, which latter might be cautiously increased. If the numbers are up to or about the standard, you will probably have too much twist in, as very uneven yarn does not take the same amount of twist, and this fact must govern

your action. If stock is poor, more twist may be required, and less tension on the yarn in backing off and winding. In other words, ease up on the yarn at all points.

(13.) I am fully persuaded that uneven yarn is made by the too great distance apart at which the back and middle rolls are made to operate. Any draught whatever, through a space greater than the length of the staple, must occasion more or less irregular drawing. These rolls should be made adjustable for the size of roving, amount of twist, etc., on the same principle laid down for setting front and middle rolls. I will give a few general suggestions for setting rolls. First, never have the top rolls closer than the steel rolls; a little further in most cases will be better. Set rolls so that the distance from surface contact, rather than the bite of rolls, shall be a guide, as rolls on some machines are larger than others, and although the bite is the same, the larger rolls lie flatter upon the steel roll and so take up more of the space between the bite of the rolls. Set them no closer than the average length of the staple under any circumstances. In fact. a little further than the average length will give the most satisfactory results. Just how much further will depend on the ease of drawing, the size of the roving, white or colored cotton, the latter drawing generally more difficult, weight applied, amount of twist in roving and evenness of same. The more uneven the wider apart, if good twist is in the roving; the more draught the closer, and the higher the speed the further apart. Setting rolls to the 1-30 of an inch at times is commendable. It may not be possible to strike the right position without experimenting. Use a yarn tester, or notice what distance of the rolls makes the most ends run best. Sometimes a few rovings do not draw well, if the rolls are pretty close together, due to some defect at the cap-bar. Get all rolls an equal distance apart. Also 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 16, 17, in the corresponding division of the first part of this essay.

CHAPTER V.

Cut yarn: (1.) Pinion gears on the mule sometimes get filled up with impacted waste and dirt, actually forcing the gear up and preventing a firm grip on the back roller, whose motion becomes delayed at each stretch. (2.) Worn stands supporting the steel roller. Generally these stands are worn nearest the source of power. (3.) Where back steel rollers are driven by a gear on the extreme end of the front steel roller. (4.) Some back stands may be set in too close, stopping the carriage before the inward run is complete. (5.) The take-up scroll pulleys may not be set to take the carriage close up to the stops. If so, set further over, so as to give more drawing surface as the mule gets in. (6.) Pressing too hard on a top roll when picking off a lap, if the ends at other boss are running. (7.) Pushing the nose peg too far out at one time, or allowing the friction (winding) to become too tight. (8.) Faller unlocking too late. It must be unlocked before the inward run is completed. (9.) Springing out of the carriage when it strikes in. (10.) Carriage striking in too easy on fine work. (11.) On fine work, the grooves made on the leather rollers by retaining the weight on them in the same place for several days. (12.) Pin on the back steel roller gets worn, or pin hole in roller is too large, causing loss of motion at the beginning of each stretch. (13.) Irregular speed, especially with fine work, so that the carriage does not strike in hard enough; also 1, 2, 4, 5.

It is not our present purpose to inquire into, nor do we understand the occasion to call for an inquiry into, those particular defects in the card room that give rise to the general appearances of the roving spoken of in this article. To do so would only prolong this essay, and be but a

repetition of much that has already been advanced by our friends, the carders. The general appearance and visible state of the roving are the only things that, in justice to them, we feel we are at liberty to make use of at this time. They have already informed us what causes contribute to the sum total of bad work mentioned under the various phases of uneven roving, and we know that the effects of bad work at any machine will be apparent in all after stages.

Raw, ragged or tender yarn: (1.) Too much "drag," or "gain" of carriage, in any class of work. (2.) Insufficient twist or slack bands. (3.) If the roving is too coarse in places, the extra twist put in, together with the "gain" of carriage on mules where all twist is put in as the mule comes out, overstrains or tears the life out of the fibres. If head twist is used, the end is apt to break down, as the twist does not pass beyond the thick places readily. (4.) Strained roving, or roving below the standard number; also, 6, 7, 8, 9, 10, 11, 12, 13, 14.

Cockled, curled, or knotty yarn: The causes of this difficulty are the same as on the frames, which see.

Slack twisted yarn: (1.) Twist band too slack, or mule very much out of square, binding cylinder and letting rim band slip. (2.) Indentations in the tin cylinder, allowing the small spindle bands to slip. (3.) Bolster rail out of line, or dirt in the bearings. (4.) Slack bands. (5.) Spindles wanting oil; also, 5, 7, 8, 14.

Kinky yarn: (1.) Too little "drag" of carriage, causing the yarn to gather on the spindle points or form kinks, and frequently on colored work, or, when there is much electricity present, the ends run together. A finer toothed drag wheel would be a great improvement in spinning, especially on colored work. (2.) Sometimes threads gather on spindle points, while the adjoining ones are too tight and straining the fibres. This is due, as a rule, to uneven roving, and considerable variation in the numbers

of the yarn made on these spindles will be observed. Where there is much of this roving found at once, as sometimes occurs on colored work when the dyer has burnt the cotton, or the carder does not make even work, it taxes the ingenuity of the spinner to the utmost to make even medium yarn. The twist, drag, tension of yarn in backing off and winding, and speed, all require re-adjusting; and when, with this, you have the troubles of electricity added, you have a most undesirable job on hand. (3.) Sometimes due to races being higher at the extreme end of the stretch. (4.) Scroll bands drawing out, the carriage being set so as to run too much on the incline as the mule gets out. Then we must move the staple on the lever to make up for loss of speed of carriage. This gives too much yarn and forms kinks. (5.) Teeth on change catchbox becoming worn so that the front roll is not thrown out rapidly enough, allowing rollers to turn, sometimes until the mule is quite out. Perhaps the movement binds somewhere, or shaft is out of line; if not, give more spring. If still unsatisfactory, replace with new or a friction cam, which is superior. (6.) Kinky yarn is hard to avoid on fine numbers with the old self operator, as the faller has to come up early to avoid cutting the yarn, and the different speed of run of the carriage prevents an invariable point for unlocking the faller. This has been overcome now on some recent makes of mules. (7.) Do not run too wide a range of numbers with the same bevel of spindle, and expect to get the best results. The finer the yarn, the more inclination of spindle to the rollers. If there is too much bevel, the yarn runs off the top of the spindles, forming kinks. For filling between 22s and 40s, an inclination of 3 to 3¾ inches when tried with spindle bevel. Back stops might be set so that the distance from top of spindle to bite of roller is 2½ to 3 inches. Have change pinions for quadrant in such cases, if you would avoid kinky yarn. (8.) Too much twist.

Harsh or wiry yarn: This kind of yarn is seldom seen in filling, on account of the small amount of twist present, but where warp is spun, the same causes that are given in Part 1 will produce the same effects here. A small amount of gain of the carriage, and insufficient tension in winding, will increase the difficulty and will show up somewhat in the filling. Under circumstances such as explained in Part 1, there will be, of course, a degree of roughness present in the filling.

CHAPTER VI.

Overstrained yarn: (1.) Lack of perfectly free movement in the winding friction, either in the worm which is turned by the governing motion, or in the worm placed within the arm of the quadrant. This latter may become bent near the top and give no trouble until the bottoms are about finished, when the nut runs up with difficulty; or the upward play of the worm may become arrested occasionally, and so shortening the length of chain and straining the yarn every few stretches; or, there may be too much upward play of worm, allowing it to rise when the quadrant arm gets to a forward position of about fifty-five degrees, thus suddenly lessening the strain on the yarn and as quickly catching it again. (2.) The set screw on the winding drum gear getting loose, preventing it turning readily. The stud, holding spur gear to the winding drum, may also become loose. (3.) Winding drum gear may not be set true. It should be set parallel with the axis of the tin cylinder. (4.) Carriage striking out or in too hard, or striking in too easy on coarse work. (5.) Squaring bands too slack. (6.) In backing off, the faller should gently follow the unwinding of the yarn from the bare part of the spindle, not push or force it down, more especially on soft twisted and tender yarns. (7.) Carriage starting to run in with a jerk. To

correct, give less winding surface, at first, to the scroll pulleys, or restrain the full action of the take-up friction as it starts in. (8.) Pushing changing lever down too early. (9.) Counter faller set too low, giving too much strain on the yarn in backing off. The finer the yarn, the closer to the threads it must be set. (10.) Faller wires not level or slack, or too light for the work. (11.) Sickles not of the same curve. Sometimes they get bent and do not keep proper distance from the spindles. Set builder faller wire three eighths of an inch from spindles, when it is parallel with their top. When turned down it should be about the same, or a little less; otherwise a soft and ragged cop will be the result. (12.) Too much gain of carriage. (13.) Letting scroll bands run too slack where such are used, instead of the side shaft to regulate the winding of yarn on the spindle. (14.) The faller may be worn at the couplings. (15.) Carriage may be too low in some places, and when it runs in, the tension on the yarn is too great at those places. (16.) The teeth on the click gear operating the winding drum gear may become worn so as to permit the click to pass over one or more teeth occasionally, as the mule starts to run in, or after it has run in a little, straining and oftentimes breaking the threads. This may be remedied by having the click throw in simultaneously with the locking of faller, as on some modern mules. See that the click does not set too high off the gear teeth. (17.) The fork on the front of the carriage depressing the lever, forcing backing-off friction in, may not be set perfectly level when mule is coming out, thus giving a jerking, upward movement to the faller as fork leaves anti-friction ball. (18.) Raising the cop too high on the spindle to compensate for loss of yarn when end has been down. (19.) Pushing nose peg too far out at once. (20.) Too much weight on faller, or, if too little, drawing the ends tight when carriage gets most in. (21.) Quadrant too far back or too far forward. In the former case there is too much strain on the

yarn when the carriage first starts to run in, in the second case when nearly in. If the quadrant can be set so as to be perpendicular when the anti-friction ball is on the highest point of incline (builder), the spinning will be vastly improved. This can be done with proper pinion gear for the number of yarn spun, if bands are used for the winding instead of the side shaft.

CHAPTER VII.

Ciliated, fuzzy, or hairy yarn: (1.) Too much gain of carriage when the total amount of the twist is put in as the mule comes out. (2.) Soft wound or fluffy roving. (3.) Rough handling of the roving; also winding off roving from nearly empty bobbins upon full ones, disturbing the parallelism of the fibres. (4.) Faller wires worn so as to catch the thread when winding. (5.) Allowing spinners to use double-joint hooks to pull laps off the steel roller, roughening up the flutes. (6.) Dry rolls for want of oil, breaking some of the fibres through excessive strain, which then lie more on the surface of the thread; also 1, 2, 3, 4, 5, 6, 7, 10, 11, 12.

Dirty yarn: (1.) Back boys fanning or blowing the waste up from the floor in sweeping or cleaning the roller beam. (2.) Carelessness in oiling the bolsters, allowing oil to get on the cops. (3.) Currents of air coming through open windows, detaching waste from the various fixings within the room, and also from the machinery, and having it fall in the work. (4.) Permitting machines to run while brushing pulleys, shafts, etc., directly overhead. (5.) Too long piecing when putting in a new roving, or clumsy piecings at the front roller; also 1, 2, 3, 5.

Badly wound yarn: (1.) Neglect to alter the short incline on builder rail in going from fine to coarse. The bottom of cop is apt to fall under, through being too round, as coarse yarn does not lie as close as fine. (2.) Carelessness

in manipulating the governing motion, allowing too much variation in tension in winding, often letting cops run under. An almost, if not quite, positive governing motion has been on the market for some time. This, with care, can be regulated fairly well, although some spinners do not speak so favorably of it. (3.) Cops wound bunchy and soft at the shoulder and too tight towards the nose, giving it a hollow appearance there. Set quadrant further back, and see if the faller wire is set as shown above. (4.) Cop tubes of unequal size, allowing yarn to run below the tubes in some cases, and, when doffed, the bottom is ragged and makes so much waste. The spinner may neglect to push them all down to the same gauge. Where long tubes are used, your ends must be well kept up to secure good winding, or loss of yarn on tube prevents firm winding. (5.) Spindle steps becoming worn, letting the spindle down, giving thereby less winding surface on the spindle and consequently soft cop. Faller wire too high up in places produces a similar result. (6.) Cops may run under through the winding chain being slack when carriage gets out, as sometimes happens from insufficient weight on the rope, driving the winding drum gear, or waste in the teeth of same, etc., preventing spindles turning as soon as the mule starts to run in, and so lets the faller go down too low. The same thing occurs when spindles uncoil too much yarn in backing off. (7.) Bands may run off spindles when the mule is backing off if the cylinder is not set properly. A straight line drawn through the centre of the whorl, and continued backward, should pass directly through the centre of the cylinder. (8.) Indentations in the tin cylinder, or slack bands. (9.) Cylinder set screws becoming loose. (10.) Too little weight on faller. (11.) Pushing nose peg too far out at one time, burying the thread in the nose of the cop. Better use the automatic nosing motion. (12.) Failing to push the cop up far enough when an end has been down some time.

In drawing this article to a close, I will add a few general remarks on spinning. Keep all the machines well levelled up and have a secure and steady foundation under them, especially the mules. Keep good bands on the spindles, and plenty of good rolls running. Keep a supply of travelers close at hand, and if the work goes badly do not wait for them to come off the ring before putting new ones on, especially those larger than No. 6, as they may be worn badly without coming off. Keep the guide wire in perfect alignment with the top of the spindle. Varnishing top rolls on colored work is good practice if carefully attended to. Scouring should be systematically followed up — a lack of which is the cause of much bad work. Do not forget the ring rail in this connection. Place it in a bath of lye to remove the dirt and oil. Have belts only tight enough to drive well without slipping, and all oil holes cleaned out and sufficient oil put in to secure good lubrication. If the ends go badly on the ring frames, breaking down at the top of the chase and whipping together at the bottom, your speed is too high, and the yarn is very uneven or weak from some of the causes mentioned earlier. A tooth or so of twist might remedy the weakness in the yarn a little, but this would cause more lashing of ends at the bottom from increased speed of traveler. A heavier traveler under such circumstances is questionable. On the other hand, where simply ballooning occurs, whether it would be an advisable procedure to remove five to seven per cent of the twist in order to reduce the speed of the traveler, and consequently the ballooning, is a question to be determined by the circumstances. It may be that there is an excess of twist that causes the trouble. An increase in the speed of the travelers of the ring rail would also assist in removing ballooning. This might be accomplished with an improvement in the build of the bobbin. A good and safe practice to adopt in all cases where the ends go badly is to

ascertain whether the proper amount of twist is being put in the yarn.

I have said nothing about the amount of draught in rollers and carriage, as circumstances will vary this, and necessity knows no hard and fast rule. Good judgment must be relied upon in every case. An approximate statement can be given as follows: In draught of rollers do not exceed for 10s, 7.35; for 20s, 8; for 30s, 8.75; for 40s, 9.50; for 50s, 10; and better results will follow in most cases if less is used. The more uneven the roving, the less draught should be used; for carriage draught on the numbers 30, 40, 50, 1½-1¾, 2½-2¾, 4, respectively, no draught being used as a general thing for numbers as low as 20. Examine the roving and size the yarn every day, so as to detect any change in the character or alteration in the stock, and govern yourself accordingly. In taking time by the forelock you may prevent some disaster. Keep temperature and humidity as uniform as possible. Good spinning can be made with a temperature of from 75 to 90, according to locality and climate. The higher temperature may be necessary in some mills not well protected from climatic changes. A warm, humid atmosphere is best suited for spinning, and is necessary to keep the numbers even. When the wind blows hard, or the temperature falls, more heat is required in the room.

CHAPTER VIII.

It is a difficult matter to spin good yarn in cold weather when broken windows and crevices in the sashes, through which you can see daylight, are allowed to exist. At such times electricity is apt to prove troublesome, as it is also in very dry days when there is little humidity in the atmosphere of a room. Heat in the former case, and moisture, in the shape of hot water sprinkled over the floor at frequent intervals, is a good remedy in such cases as the

latter. A cold atmosphere hardens the wax on the fibres and lessens that adhesiveness spinners so much desire, causing ends to break and fibres to lap on the rolls. When there is an excess of moisture and heat, dry, hot air, if it could be obtained, would be an excellent thing. The burning of gas jets might help somewhat by supplying dry heat. Speeder tenders, when piecing broken roving, frequently give more twist to the roving than they should, and the spinning rolls fail to draw it. In both mules and frames several yards will sometimes be found to come through the rolls without any draught, and sometimes get wound on the cop or bobbin, and very often balloons out and breaks down adjoining ends, besides spoiling the rolls for good drawing. Keep an eye on that back boy when doffing, lest he bend the cop too much at the top or pull it out at the bottom; also the frame doffers, lest they loosen the yarn on the bobbin when it (the bobbin) adheres tightly to the spindle. Carelessness and rough handling of the yarn, after it is spun, damages it for proper and satisfactory working in the subsequent stages.

Overseers should preserve a dignified and manly bearing towards the help, and see that all orders are carried out. A lack of discipline in a room soon brings things into confusion. An overseer lacking in mechanical ability may succeed at one mill and make a failure in another where a different style of machine is used. His knowledge should extend back of and beyond his own department. If an overseer does not understand his business in every detail, he may always appear to be busy and yet accomplish little or nothing, work hard and have little to show for it. Such are generally so-called cheap men, who want to experiment and learn something at the company's expense, and are willing to take a position for what they are offered, and, realizing that they must do something, keep themselves always at work. The super, observing this, flatters himself on his selection. But "all 's well that ends well."

Again, first-class overseers sometimes have their hands tied through unwise interference on the part of the super, who will insist on having his own ideas carried out in regard to speed, draught, amount of waste in stock and supplies, regardless of consequences, and blame the overseer in the meantime for the bad work. These matters should be left to the judgment of the overseer, if you have the right man. Some machines will stand more speed and draught than others, and who knows these peculiarities better than an overseer? Good work in paying quantities cannot be made when poor or insufficient supplies are forthcoming. Compelling an overseer to make bricks without straw, also, is carrying imposition too far. Again, a really first-class overseer is forced to realize that his compensation is too small for the service rendered, the strong tide of competition being an excuse to take an undue advantage of a man who may not be in a position to resist. Consequently he loses interest in his work, and the help soon learn to appreciate his lack of restraint. Again, there are those who cannot have that as an excuse, but are well remunerated for their labor. Some of this class are totally indifferent to the interest of their employer, and seek only to do enough to retain their position, and become careless in the repairs of the machinery. Throughout the room there is evidence of the motto, "Anything that will pass is good enough," staring the observing ones in the face. No system, no discipline, unless the super bears down on them too hard. There is only one remedy: Remove the cause. There are also help in a room who care only for the face of the paymaster.

Bad work will arise from giving a spinner more than he is capable of doing well. Inefficient and careless help should be given an opportunity to try their fortune in some other man's mill. Then, again, there are underpaid help, which results in discouragement, and the work thereby suffers; or a bustling, fussy overseer, who tyrannizes over

his help, who, in turn, endeavor to get even with him at every opportunity. Agents and all in authority should mingle a little humanity in their dealings with labor, and note the result. There are few whom a kind, encouraging word, or a properly chosen compliment bestowed upon their endeavors, would not stimulate to do better work and more of it.

Broken windows, ragged curtains, unwhitewashed walls, unpainted ceilings and dimly lighted rooms, with an abundance of dirt and waste over everything movable and stationary, are things demoralizing to help. They stifle refinement of feeling, blunt the inventive faculty, steal away their sense of self-respect, rob them of their manhood and womanhood, and almost reduce them to the level of the machines which they operate. Pleasant surroundings, both inside and outside a mill, are conducive to the happiest results, both as regards the stockholders and the employees.

SAMUEL ROWCROFT.

SAMUEL ROWCROFT,

OF KINGSTON, ONT.

Mr. Rowcroft was born in Heaton Norris, in the borough of Stockport, Cheshire, England, in the year 1847. He received a common school education, and commenced to work in a cotton mill when about eleven years old. He worked for Messrs. Ashton Bros. & Co. at the Sheepwash Mill as back boy, piecer, and mule spinner until 1868, when he came out to the United States. He worked in Andover, Henry County, Ill., for a year on a farm. He afterwards went to Rock Island, Ill., and learned to be a stove moulder. In the spring of 1872 he went to Chicago and worked in the Chicago Stove Works until the fall of 1874, when he left to go back to England. He worked in Stockport as a mule spinner until 1879, when he came out to Dundas, Ont., and worked for the Dundas Cotton Company for about two years. He left there and went to work in the Craven Cotton Mill at Brantford, Ont.; after being there a short time, he was sent for to go back to the Dundas Cotton Mill to take charge of a part of the ring spinning. When the Kingston Cotton Mill of Kingston, Ont., started, he was sent for to go there, where he worked until 1890, when he left to go to Hamilton, Ont.; not being suited there he moved to Capron Mill, near Utica, N. Y. He then went to work in Kingston again, where he is still employed by the Dominion Cotton Mills Company as overseer of mule and ring spinning. His father and mother, and also his grandfather and grandmother, all worked in the cotton business.

PRIZE ESSAY ON SPINNING,

NO. 6.

BY SAMUEL ROWCROFT.

Though I am only a new subscriber to the *Reporter*, I take the opportunity offered of competing, for I think that the offer is a very liberal one, and ought to create enthusiasm among both young and old, whether they are overseers or not. The subject is a broad one, and there is plenty of room for improvement. This being my first attempt, I expect to be left in the race, but if anything I may write should cause some of your young subscribers to put their studying caps on, I shall be satisfied.

The reasons and remedies for bad work in cotton spinning: Bad work in spinning rooms may be caused in a variety of ways. (1.) The yarn may not have twist enough in it, which will cause the ends to break badly, especially after doffing, when the pull of the traveler is hardest. To remedy this you must either put in more twist or use lighter travelers. Some overseers will use a little oil in this case, but I myself do not approve of it, as I think it has a tendency to cause more lint to adhere to the travelers. (2.) Fluted rollers may not be set right. If your stock is short, you need to have your rollers set very close. If long stock is used, they should be set further apart. Here is a place where the overseer needs to keep his eyes open and watch the work, or he may have the fibres crowding one another, or they may be pulled apart through the rollers being opened too much. (3.) Lumpy or hollow rollers cause uneven and cut yarn. All rollers should be

examined before being used, for I think that bad rollers cause more bad work than any other thing in the spinning room. They should be looked after all the time, and the help should be taught to keep a sharp eye on them, and always put them in the right way. (4.) Single and thick roving. All these should be saved and the carder's attention drawn to them. The help should not be allowed to straighten them or pass them down on the quiet to the roving frame tenters. (5.) Bad piecings are a source of annoyance, and are caused chiefly by spinners leaving long ends when changing rovings, or not twisting the threads together, or by piecing up with under-clearers stopped. This is where an overseer and second hand want to keep their eyes open, and any one caught doing it after being cautioned should be instantly discharged. It will have a salutary effect on the rest of the help, as most of the help in ring spinning rooms are young, and careless at times. (6.) Running travelers too long. Travelers when worn, will chafe the yarn, causing it to be rough, uneven, and liable to break often. The help should be taught to look after them. They may be detected by breaking often and the tension there is on them. (7.) Spindles out of centre of rings, and thread wires not alignable. This point needs watching closely, as it is a source of great annoyance to spinners, and will cause many a string to get broken in preference to piecing up the ends every time the spinner comes around to them. I have found out that a little time spent in explaining little things to the help pays in the long run. (8.) Dirty rollers, top and bottom clearers, and roving guides, is another source of uneven and dirty work. Every overseer should put his foot down on this at once. Of course there are places where help is scarce and you cannot do as you would like to, but on this point you need to be strict. (9.) Overdraft. In some mills this is a serious trouble, and it is a great drawback to good spinning. It is common in small mills, where a variety of counts have

to be spun out of the same roving. (10.) Oiling spindles and rollers irregularly. When spindles are not oiled often enough, they get gummy and make it harder for the bands to turn, often causing slack twisted yarn. When rollers are not oiled as often as they should be, or some of them are missed through the carelessness of the oiler, the yarn will come through heavy and it will look as though the rats had been at it. The leathers will get rough through chattering and are soon spoiled. This is another place where everlasting watchfulness is needed.

There are numerous other things that will cause bad work in spinning rooms. Most of the above-mentioned causes and remedies will apply to the mule room, with many others besides. I will give a few of them: (11.) Carriages out of square will cause a deal of cut yarn. They should be squared often, as the bands drawing out the mule carriage are continually stretching. (12.) Scroll bands too tight or slack. They should be set so that the mule after backing off should start in without a pluck, and when getting into the beam, the check should hold the mule from striking in too hard, or it will be likely to cut the yarn, especially at the ends of the frame, or if the check is too tight it will not allow the mule to go in, sometimes causing the cam to change before the fallers have unlocked properly, cutting the yarn and sometimes breaking all the ends down. (13.) Rim bands running too slack. This is another source of bad work, and allows the mule to start with a jump. Then making a pause, the mandoza weight will sometimes slip a tooth, causing the teeth to get broken in the drag wheel. The threads will twist together, causing double threads, which are allowed to run without being broken out, especially just after doffing. Some spinners think that they are gaining time by allowing this to go on, but I would not allow it in my room. It is penny wise and pound foolish. (14.) Fallers locking too soon or late is another source of bad and slovenly work, causing the

ends to be broken just as the mule begins to go in. To remedy this, back the mule off slowly by hand. Then you can see whether the fallers go down slower or faster than the yarn uncoils from the spindles, and regulate the backing-off chain accordingly. When the mule runs into the beam and unlocks late, the yarn will coil on the spindles too close. If it unlocks early, it will put a snarl on the spindle point. To remedy this, move the block that strikes the bayonet to suit. (15.) The quadrant not being set right is another source of bad work. It will cause the mule to wind badly, if the quadrant is too far in towards the beam. The fallers will have a tendency to lift when the mule starts to go in, sometimes giving the winding catch a chance to slip and causing the cops to be run under. Then, as the cop is getting full, the nose peg has to be put down quite a way, causing the fallers to duck, or else you must keep turning the winding back. If the quadrant is too far back from the beam, the winding will be too tight at the commencement of the stretch, and the fallers will lift as the mule goes in, causing snarls on spindle points and often letting the winding catch slip just before the mule gets into the beam. To set the quadrant, stop the mule going in at the top of the machine. At this point, set the quadrant upright. (16.) Carriages knocking out too hard is another source of bad work, causing the yarn to be pulled by the carriage rebounding, especially on old mules. This may be remedied by pulling the scrolls on the back shaft a little over so that the drawing-out bands will come on the small part of the scrolls, causing the carriage to strike out easier. If the scrolls are pulled over too far, the carriage will be apt to slip off the catch, causing the fallers to get locked, and in unlocking them, if the yarn is not lifted clear of the spindles, there will be considerable ends broken by lapping around one another when the carriage goes in. (17.) Another reason for bad work is in the temperature of the room being neglected. Some-

times we wonder what makes the work change so much in a short time, when, if we keep a close watch on the thermometer, we should find the cause very often. I find the best results in keeping the room at about seventy-eight or eighty degrees, if the weather is damp. I prefer to keep it at eighty or over in preference to letting the room get cold and being troubled with top rollers licking, thus causing bad work and spoiling the rollers as well.

There are a great many more reasons, such as fallers, sickles, and wires being unlevel, chains on the fallers not being set right, counter belts too tight, causing the mule to jump out, saddle wires too long, back weights too high or too low or twisted sideways, short saddles not on right, careless doffing, or winding on to the spindles after piecing up the ends when they have been running down (which is a frequent occurrence after doffing) not having the tubes set down even, or careless starching when no tubes are used, slack bands, and a host of other things which call for the strictest attention on the part of every one employed in the spinning room.

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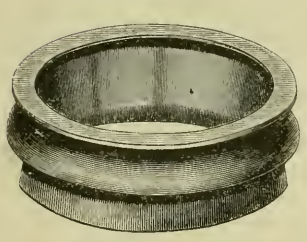
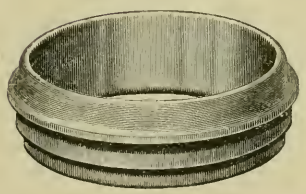
U. S. A.

Steel Spinning and Twister Rings.





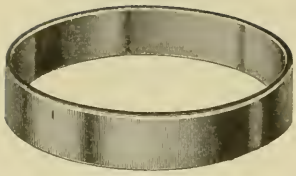
For nearly twenty-five years we have made a specialty of the manufacture of SPINNING AND TWISTER RINGS. Our patented tools have revolutionized the ring business, and have been adopted by the leading makers in the United States and England. Our PATENT METALLIC BURNISH, used exclusively by us, is to the spinning ring what the ball bearing is to the bicycle, and our DOUBLE BURNISHED RIBBED RING is the lightest running ring yet produced.

We make every variety of SPINNING AND TWISTER RINGS. Our NARROW VERTICAL RINGS are very popular for twisting. These rings are reversible and cannot fail to give satisfaction. We furnish either CAST IRON or PLATE HOLDERS for the DOUBLE ADJUSTABLE RING.

We are constantly making experiments to improve the process of manufacture, and spare no expense in order to secure the best methods obtainable. Manufacturers desiring to purchase rings or make changes in spinning will please send to us for information and samples before ordering of other parties.

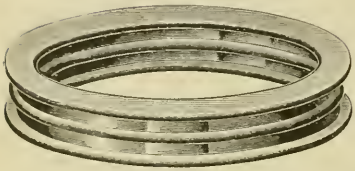
The Burnished Spinning Ring.

A Long Felt Want. — It is impossible, by any method of polishing, to produce a new spinning ring that will run as light as one that has been in use several months. Until new rings have become burnished by the action of the travelers, they have always caused a constant breakage of ends, an immense waste of travelers, a falling off in the quantity of yarn produced, and a loss in quality as well, to say nothing of the vexation among the operatives arising from the ill running work, the dissatis-



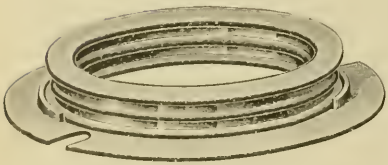
faction among them caused by the increased labor they are called upon to perform, the consequent neglect of their regular work, and the serious effects of these evils upon all succeeding operations. These draw-backs have grown in seriousness as the speed of the spindles has been increased, and some remedy for these evils has been a long felt want.

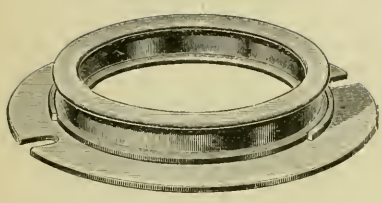
The Want Supplied. — Some seven years ago, after many experiments, we succeeded in originating a machine that will give new rings exactly the same burnish as that produced by the traveler after the rings have been in use several months. The process by which this long felt want was supplied is patented, and is known to the trade as our patent metallic burnish.



Results Secured. — Most remarkable results have been secured by the use of rings burnished by this patent process. Tests show that the use of the burnished ring greatly reduces the consumption of travelers, causes less waste, minimizes the breaking of ends when new rings are started, and materially improves the quality and increases the quantity of yarn spun.

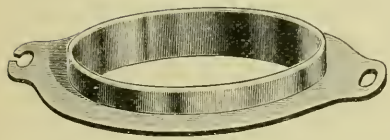
Story of a Test. — A trial test was made recently on two spinning frames of 160 spindles each. Time run, 20 hours; warp, No. 29; Whitin Gravity Spindle making 9100 revolutions per minute; 1⅝ inch Whitinsville Spinning Ring Company's burnished and unburnished rings, 160 of each. The test was made in the worst possible weather for spinning for the purpose of showing the results at the most critical time for new rings. On the burnished rings the standard weight of travelers was used, that is, the weight used for the same number of yarn in other parts of the room. Weight of traveler, 10 equal 6 grains. On the unburnished rings, 10 travelers equalled 5 grains. Up to the time the first traveler came off the burnished rings, which was just 20 hours, 430 travelers had been used on the unburnished



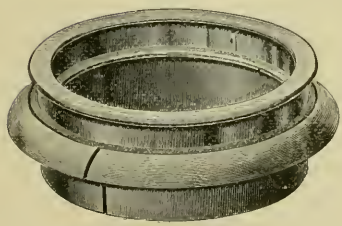


rings. Doubtless the same, or nearly the same, results would be obtained under the same condition of the atmosphere in any mill. When the results of this test are considered in their relation to the operatives, and the quantity and quality of yarn spun, the value of the burnished ring will be readily recognized.

Other Tests. — Other tests have been made from time to time. None of these have shown less than fifty per cent saved in travelers for the first ten days by the use of the burnished ring, and all of these tests prove that there is a large saving for several months. Manufacturers who have used burnished rings are satisfied that they are doing all that is claimed for them, and even more. We are convinced that it would be far cheaper for manufacturers to pay double the present price of the burnish, if necessary to secure it, than to use the ordinary unburnished ring.



Burnish aids the Traveler in its Work. — When we fully consider the amount of labor performed by the traveler, why should we hesitate to give it all the advantages we can? Often it is the most troublesome part of the supplies needed, because it is a continuous expense, and many are used. The burnished ring aids the traveler in its work, giving it every advantage in ease and lightness of running. The less the friction between ring and traveler, the less the expenditure for travelers. The burnish reduces friction to a minimum.



Durability of the Burnished Ring. — Now that the varied advantages of the burnished ring have been set forth, just a word about its durability. When the burnished ring was first introduced, some spinners claimed that the burnishing would affect the life of the ring, and that rings subjected to that process would not prove as durable as rings burnished by the action of the traveler. Since these objections were raised, numerous tests have been made to ascertain the truth in regard to the comparative

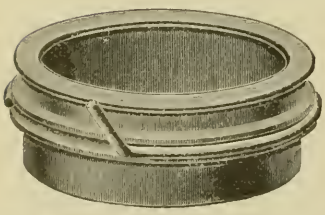
durability of the burnished and unburnished rings. Whitinsville Spinning Ring Company rings, alike in every respect save the burnish, were placed side by side in the same room, and even on the same frame, careful note being taken of the wearing qualities of each, and in every instance the burnished rings proved the more durable.

To Sum Up. — Now to sum up and state the advantages of the burnished ring over the unburnished, in a concise form: **Great Saving of Travelers; Decrease in Amount of Waste Made; Better Quality of Yarn Spun; Consequent Benefit to All Succeeding Operations; Increase in Quantity of Yarn Produced; Aids the Traveler in its Work; Dispels Dissatisfaction Among Employees, arising from Ill Running Work; Reduces Work of Operatives; Allows Operatives Opportunity to do Their Work Well; Adds to the Durability of the Ring; Increases Production and Lessens the Cost.**

U. S. Standard Traveler Cleaner.

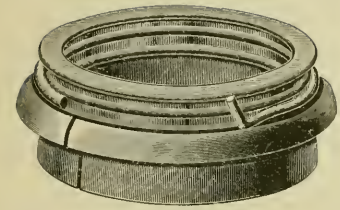
Patented Feb. 26, 1889.
" Oct. 21, 1890.
" Oct. 21, 1890.

A Perfect Traveler Cleaner.



Greatest Evil in Cotton Manufacturing. — "Uneven Yarn is the greatest evil in cotton manufacturing. To remove this evil has been the aim and object of inventors and artisans from almost the very inception of the spinning industry."

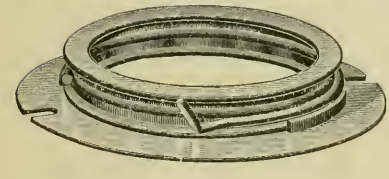
One Cause of It. — Dirty Travelers, travelers loaded with lint, are a prolific source of uneven yarn. They render the yarn kinky and overstrained, seriously affecting the quality of the product in subsequent processes. Loose waste floating about the room gathers on the traveler, impeding the passage of the yarn, increasing the weight of the traveler, breaking



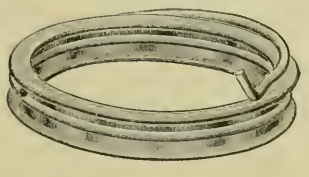
ends, and adding materially to the work of the operative. Elastic yarns are the best, and the elasticity is largely controlled by the traveler. Unless the traveler is kept free from accumulations of waste or lint, we cannot secure the elasticity desirable, as the finer places in the yarn are so apt to break.

A Remedy. — We have a remedy for that part which dirty travelers play in the making of uneven yarn. That remedy is our United States Standard Traveler Cleaner, which has only to be seen to be appreciated. It keeps the travelers thoroughly cleaned, and does it automatically. It requires no attention from the spinner.

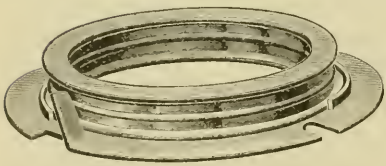
Other Devices Unsatisfactory. — Heretofore all traveler cleaning devices put upon the market have proved very unsatisfactory, to say the least. They continually worked out of place and were lost, or became clogged with lint, or had to be adjusted every time the ring was moved; in short, could not be depended upon to do the work for which they were intended.



Difficulties Overcome. — But all that is now past. All these difficulties have been overcome by the introduction of the United States Standard Traveler Cleaner, which is far superior in every respect to any other on the market. It cleans the traveler automatically. It cannot get out of place. It never gets clogged with lint. It will pay for itself many times over in the saving of travelers. It saves labor by removing one cause of broken ends and relieving the spinner of the necessity of picking the lint from the travelers. By keeping the traveler free from lint, it relieves the yarn from any undue strain, the threads consequently retaining their elasticity and evenness as well, properties so essential to good weaving.



Leading Points of Advantage. — The United States Standard Traveler Cleaner has many leading points of advantage, whose value will be recognized by practical spinners



everywhere. It is neat, simple, cheap, durable, effective, easy to apply, always in place, and is self cleaning.

It is the Simplest. — BECAUSE it consists of one piece of plain wire. No drilling or tapping of rails necessary to apply it. No screws needed to secure it. No getting out of place when once in position.

It is the Cheapest. — BECAUSE the cost of applying it is nothing, and because it does the work better than any other.

It is Easiest to Apply. — BECAUSE it can be sprung into place instantly, not more than ten minutes being required to apply it to a frame of one hundred and sixty spindles.

It cannot get out of Place. — BECAUSE it encircles the ring, is practically a part of the ring, and whatever position the ring may be in, the finger of the traveler cleaner is always at the proper distance from the flange.

It is Self-Cleaning. — BECAUSE the angle given to the projecting finger prevents the accumulation of lint or dirt, and the circulation of air produced by the speed of the bobbin is sufficient to keep it clean.

Why use the Traveler Cleaner? — When the amount of labor performed by the traveler is fully considered, why should we hesitate to give it all the advantages we can? Every bit of help given the traveler adds something to the quality of the yarn, to the quality of the fabric, and consequently to the profits. Here is an opportunity to aid it. Give the UNITED STATES STANDARD TRAVELER CLEANER a trial and be convinced of its merits. We furnish the plate holders with turned up traveler cleaners where parties prefer that style.

WILLIAM WHITTAM, JR.

WILLIAM WHITTAM, Jr.,

OF WESTERLY, R. I.

William Whittam, Jr., was born in Preston, Lancashire, England, twenty-nine years ago. He first started work in the warehouse of the Lutwidge Mill, at the age of twelve, of which mill his father is superintendent. Afterwards he went into the mule room, and then the card room as stripper and grinder, then section hand, and afterwards as overseer. From this position he was for about a year an assistant to the superintendent and spinning overseer.

From this firm he went as overseer to Houldsworth Brothers, Bolton, England, and then to Rylands & Sons, sometimes known as the Dacca Twist Company, as overseer of carding. This is a large firm, having over one hundred and seventy cards, of which one hundred and thirty-nine are revolving flats. He came to this country in 1890 on a visit, and while here engaged as overseer of carding with the Clark Thread Company, Newark, N. J., from which place in 1891 he engaged as superintendent with the William Clark Company, thread manufacturers, of Westerly, R. I., at that time in process of erection.

He is the author of a work on cotton spinning which he has run through one edition, and holds first-class honors certificates in cotton spinning and cotton manufacture from the city and guilds of the London Institute, also "Full Technological" certificate in these subjects. He has also graduated in mechanics, machine construction, mathematics, magnetism and electricity, and other scientific subjects, and is the holder of the gold medallion of the St. John Ambulance Association.

PRIZE ESSAY ON SPINNING,

NO. 16.

BY WILLIAM WHITTAM, JR.

CHAPTER I.

In this essay it is my purpose to begin at the beginning and give all the causes and remedies for bad work in cotton spinning rooms that I can, whether they are attributable to the spinning room or to any other department; for, since bad work can be and is caused in other stages of the manipulation of the material than in the spinning room, that spinner who cannot discriminate between the bad work caused in his department, and that for which other persons are responsible, will, in my opinion, often find himself in an awkward predicament; and every person in the mill ought always to be on the alert to prevent faults, rather than to check them after they have occurred. In order to make myself more readily understood, I will classify my remarks under the three following heads: —

First. Causes that are attributable to the raw material previous to its manipulation in the mill.

Second. Causes that may be referred to improper or careless manipulation in the various processes to which the cotton is subjected in its preparation for the spinning machines.

Third. Causes and their remedies in the cotton spinning rooms.

To commence with the first division of our subject: There is a very considerable amount of trouble and bad work caused in spinning rooms, and indeed in every other

department of the mill, owing to large quantities of unripe and imperfectly developed fibre being mixed during the collecting and packing operation with the good stock, causing a large amount of waste to be made, and soft yarn is very often the result; and in cottons of the lower grades these evils are largely increased by the practice common, if not general, among cotton growers, of collecting the immature pods on the cotton plants, after the latter have been killed by the frost, or from any other cause have ceased to grow. These are dried, the lint stripped from them and added to the bulk. Again, the same evil results in spinning may be caused by carelessness or ignorance during "ginning" or separating the fibre from the seeds, to which they adhere very tenaciously. When the "gin" is overcrowded, or when the gin blades rub against the grate bars, the cotton is seriously injured by becoming "nepped"; that is, the fibres are caught and rolled into little balls about the size of a pin's head, and they form a great defect in yarns when present in any considerable quantity, and are very difficult of removal in any stage of manufacture. The remedies which can be applied in the mill for these evils lie in a strict and intelligent examination of every bale previous to its incorporation into the mixing, and the rejection of those bales in which these objectionable features are found to exist to any abnormal extent.

We will now consider the second division of our subject, or, "causes that may be referred to improper or careless manipulation in the various processes to which the cotton is subjected in its preparation for the spinning machines." In the first place, in this division, will come "mixing operations," and the saying that "there is a good deal of spinning done in the mixing room," should be a sufficient proof of the importance of good mixing, and I may lay it down as an almost axiomatic truth, that long and short stapled cottons should never be mixed or

worked together. Where different kinds of cotton are mixed together, the greatest care should be exercised in the selection of the stock, so that they may all be of one length, or as nearly so as possible. If short and long stocks are run together, excessive waste and weak and poor yarn, consequently bad spinning, will be the result; for it is a matter of impossibility to set the rollers either in the card or spinning rooms to work two lengths of stock at one time with advantage. If they are set for the long stock, much of the short must necessarily fall out and become waste, and if set for the short, the long will be broken and also fall out. The rolls may of course be set in an intermediate position, and this, though tending towards it, is far from eradicating the evil. Indeed, the only way in which even a moderate perfection of spinning can be attained is by careful selection of the raw material, with regard to its general uniformity and adaptation to the counts into which it is to be spun.

Next in order for our consideration is the picker room and its machinery. With regard to this room and also to the carding engines I may say, scutch and card light, if you want to have good spinning, and do not run your beaters too quickly, or put your cotton through too many beaters. All the above evils have a decidedly injurious effect on the cotton, destroying to a much greater extent than is often suspected the convolute form of the fibre to which it owes its good spinning properties. The stock that is treated with moderation, judgment, and skill in this department is less damaged, and will run with less twist, and causes less trouble and bad work in the after processes, and the yarn is stronger and the production greater. And here, while speaking of the first mechanical treatment of the stock, I may state that if you scutch and card light and quick, and have slow speeds at drawing, slubbing, intermediate, and roving, and just as high speed as you can conveniently get at the spinning machines, you

will be very hard to beat either in economy, quality, or quantity, and that the reverse to the above will be productive of much loss, waste, and very bad spinning.

Imperfect air currents will cause irregular laps to be made, and thus cause irregular and bad work in every other part of the mill. Having the fan that induces this current run too quickly will cause too strong a current to be generated, and thus carry on the short, weak fibres particles of leaf and other light foreign matter that by accident or design may be present in the cotton; and this has a decidedly deteriorating effect on the spinning. The remedy for the first or irregular draft is to have all the doors, sides, and casings of the machines air tight, and the draughtway entirely free from obstructions, and for the second, to run the fan slower. Irregular feeding at the first machine, letting laps run out, or piecing them up double, "licking," or not unrolling in an even sheet, but taking part of another layer of the lap, with the result of making one part single and another double, are all agents in the production of bad spinning. These are also applicable to the carding engine.

The remedies for these faults are care and attention on the part of the help, and the supervision of the overseer, and for "licking," take some weight off the lap roller, and reduce the speed of the fan a little.

CHAPTER II.

We must now consider the next process, in so far as it has to do with our subject. Carding is probably the most important process in cotton manufacturing, and when inferior work is produced in this process it cannot be remedied in any subsequent stage; being the final stage of cleansing, wherein all foreign matters should be removed, and all immature fibre, etc., extracted, if this process is not given the strictest attention in every way, bad spinning will be

the result, for the particles of broken seed and leaf are carried through succeeding operations without being particularly conspicuous or troublesome until the spinning process is reached, when they cause many broken ends, speckled yarn, etc. I will here again impress upon every one that if good results are desired, it is essential that cards be not overworked, that the carding should be what is called light weight; but where heavy carding is a necessity the closest observation and nicest discrimination are required from the carder, not to allow the cotton to be delivered before it is sufficiently carded, and on the other hand never to allow it to remain too long in the card, for both these points will produce bad spinning and weak yarn, the first in not taking out all the unripe, immature fibre, and the second in destroying the elasticity, nature, and convolute form of the fibre.

The grinding of carding engines is also a matter of considerable importance and must be attended to with some degree of skill and judgment, for more than is often thought, in the production of good carding, and consequently good spinning, depends upon good grinding; if the grinding is not done skilfully, the cards cannot be set with that degree of accuracy that is indispensable to the production of good work. Again, neglecting to strip often enough allows the cards to get clogged up or the wire filled with short waste or strippings. When this is the case, the cotton is simply passed through the card, and elongated or drawn, but does not receive any appreciable carding. Then, to prevent or remedy these evils, card lightly, grind and set skilfully and carefully, strip often, and have your cards on a solid, or, at any rate, a firm floor, free from vibration and perfectly level, so that there may be no unequal pressure of the working parts upon the bearings and frame work, for if you have vibration in your cards you cannot have first-rate carding; but all these things require to be checked by very close observation of results. The railway heads are

also responsible for a considerable amount of uneven work, especially when the atmosphere is in an abnormally dry state, thus affecting the trumpet, so as to cause it to speed the rolls when this is not really necessary.

The remedy for this is an artificial humidification of the room, and having the machine, especially the trumpet, in metallic connection with the earth, say through the medium of the gas-pipes, where those are present; but I will refer to this point again when speaking of the action of electricity and the atmosphere in its different conditions on the cotton in its working in the mill. And it is not to be forgotten that the setting of the feed rollers in openers and pickers must not be overlooked, for if not set close enough their function is necessarily performed in an imperfect manner, the cotton being taken from them in lumps, and in the case of the picking machines is opened and cleaned very imperfectly, and in the cards it greatly hinders the disentanglement of the fibres, and causes the web to be delivered in a cloudy state, instead of as a clear, level, and clean surface.

In considering the drawing, slubbing, intermediate, and roving frames, I will only speak of the defects and irregularities peculiar to these machines, since the remarks I shall make on the rolls, creels, etc., of the spinning machines will be equally applicable to these frames. Not having the stop motions of the drawing frames thoroughly clean, well balanced, and in good working order, is responsible for a good deal of uneven and irregular work.

When the frame does not stop, on an end breaking or running out as the case may be, much waste is made if the hand is inattentive in the discharge of her duties, but if the uneven sliver or single is allowed to pass, the result is, that it is very seldom properly balanced in the subsequent operations of doubling. This also applies to the doubler, or machine for making laps for the finisher card, and for those for making laps for the comber, where these machines

are used. The amount of drawing to which any sample of cotton is subjected must always depend on its nature, those of a strong, wiry nature being better adapted for a rather more severe treatment than soft, sericeous cottons. In the slubbing, intermediate, and roving frames or speeders, much bad and irregular work is caused by having imperfect fliers when the hollow leg is rough on its inner surface. The roving is weakened by being made fuzzy or rough and weak. This may be obviated by having them polished and a smooth face put on them. The same result is brought about in some instances by the help knocking the flier down on the spindle with one of the top flats or clearers, when from some such cause as the slot at the top of the spindle being filled with dirt, or the pin of the flier being crooked, it (the flier) does not slip into its proper position as readily as it ought. This often cuts the flier just where the roving passes over it, down into the leg of the flier. The obvious remedies for these evils are in having the slots systematically cleaned, and straight pins put in the fliers where required, and in strict instructions being given to the tenters to desist from this practice, and in the overseer taking care that his instructions are carried out. When the presser on the flier leg, where used, is stiff, and consequently does not submit to the centripetal force generated by its revolution, it causes soft bobbins to be made and a weak roving to be produced, which will break often when unwinding at the next creel, thus causing annoyance and bad spinning at the final operation. When these bobbins are found, they ought to be at once reported to the boss, second hand, or whoever is responsible, and the flier should be at once examined and made to work perfectly free and easy. Sometimes the wrong ratchet wheel is put on, when it will make the frame run either too tight or too slack, dependent on whether the wheel has too few or too many teeth in it, causing the roving to be stretched when it is too tight, and when too slack the tenter will often wind up

the wheel a tooth, thus not only taking up the slack rove, but for a time making it run too tight and bringing about irregular and bad work in all after processes.

Again, when the cone drum belt is too slack, the same thing happens, the help in charge of the frame winding up a tooth, and as before stretching the rove. The remedy for the wrong wheel is evident, that is, putting on the right one; and for the slack cone belt, having them tightened and kept in good condition, for by attending to this very important point, better work will be made and the production increased, and there will be less irritation for the help and everybody concerned. When the small bevel wheel in speeders is not properly geared, or when it or the wheel into which it gears is worn, it will cause the bobbin to jump or dance and break the end, or stretch the rove. This may be obviated by having a systematic inspection of these wheels, and having the help report such cases at once. Sometimes the same effect is produced when a bobbin or top shaft is crooked or strained. In this case it will affect several bobbins.

The springs being too weak that work the catches of the ratchet wheel, will cause much bad work. I have often noticed a practice which some frame tenters have, and which ought to be well looked after and put down with a strong hand; it is when they have allowed an end to remain too long down and the frame to run too long before the end is pieced up. The bobbin gets too small to take up the rove as quickly as it is delivered by the front roll; then, rather than be taken to task for having a spindle running bare, they sometimes put a piece of waste under the weight hook of the front roll, and this increases the friction and causes the front roll to run slower, thus delivering a less amount of rove than the others, making the bobbin wind, but as a consequence affecting the draft, making it less and the roving coarser, and where there are four ends to a roll it affects four bobbins; and on one occasion I

put four bobbins of this sort in the mule and tested the cops made from them, and instead of 50s being made, they sized or wrapped 36s — a very serious variation. Of course, when loose bossed or shell top rolls are used, this cannot be done. Any of the help who are found guilty of this practice ought, after having been once cautioned, to be discharged as a warning to the rest of the seriousness of the offence.

CHAPTER III.

We must now proceed with the third division of our subject, namely, "Causes and their remedies in the cotton-spinning room," and I will, in dealing with this part, again sub-divide it into three divisions: —

a. Causes that are applicable to both ring frames and mules.

b. Causes that are applicable to mules only.

c. Causes that affect ring frames only, with the remedies for the above.

In division *a* we will first review the causes of bad work for which imperfect roving is responsible. Stretched or cut roving causes a great amount of trouble in breaking, when unwinding in the creels, or when delivered from the front roll. The cause of its breaking, in the former case, is its being weakened, and thus being unable to bear the strain to which it is subjected in being pulled off the bobbin; and in the latter case it is not sufficiently strong to withstand the weight of the traveler or the counter faller, as the case may be. The remedy for these faults is to be found in the points which I have already enumerated under the head of speeders, and those I shall speak of shortly in dealing with the injuries to the rove or thread caused by carelessness, misarrangement, or bad condition of the rolls, and those that the appliances of the creel, etc., are responsible for. Soft bobbins I have already dealt with, and it now only remains for me to point out that the

roving must have the right amount of twist in it; for, if too little twist is put in, the bobbins will not run off in the creels, or if they do so the rove will be stretched, and in either case the result will be the same as that to be found in cut and stretched roving. When too much twist is in the rove, it will be but imperfectly drawn in the rollers, and the result will be an uneven, raw, and "cockly" looking thread; the obvious remedy is to have the right amount of twist, and, though there is a rule for obtaining this amount, it must be used in conjunction with a close observation of the bobbins when being run off, for weaker cottons require more twist, and stronger and long stock less twist, than that obtained by rule. Here I will say that you should always have a little more twist in than is required to pull it off the bobbin, for the feet of the creel pegs are almost always clogged with waste cotton, which increases the friction very considerably This, of course, applies to all speeders, except the slubbing frame, as well as to the spinning machines. The roving must be of the right hank, for if too fine the yarn made from it will be the same, and bad spinning will result from there not being enough twist in the yarn, and consequent breakages will occur, the twist gear having been calculated for the right hank roving. When too coarse, the yarn will have too much twist, and run into snarls from the same reason.

We will now go on to the causes of bad spinning and their remedies, which the creels, rolls, and all the appliances for the attenuation of the fibre are responsible for, and careless manipulation in this process; and all these causes, reasons, and remedies are equally applicable to speeders as well as mules and ring frames, and also those of the rolls, to the drawing frames, combers, and eveners. Then, in reference to the creels: When the bottom points of the creel pegs are allowed to become too blunt, or too much waste cotton or "fly" is allowed to accumulate under these points, the friction is increased to such an extent that the

rove is either broken or stretched, and the same evil results follow as those previously enumerated. Again, when putting in a fresh stock of bobbins, or "creeling," as it is called, the help often leave six or eight inches, and sometimes even more, of rove hanging, which causes great irregularity in the yarn, and consequent bad spinning; and when two ends are run up behind, as in intermediate and roving frames, and in many instances in mules and ring frames, when an end breaks or runs out from behind it is allowed to run single, and the result is again bad spinning. In fact, this making of long or double piecings is a point which must be carefully watched in every machine in a cotton spinning mill, from the picker to the spinning frame.

In speaking of the top rollers, a few words on roller covering will not be out of place, since it is impossible to over-estimate the importance of this operation in the production of a good, level, clear, and strong thread. It is absolutely necessary, in order to produce such a thread as I have described, that we should have good top leather rolls. In the first place, the leather itself must be of the best quality, and any false economy in this is bound to produce unsatisfactory results. The leathers, before being cut up, ought to be very carefully picked and sorted, as there is a very great difference in their thickness and quality. The thinner skins should be used for mule and ring frame rollers, and the thicker ones for drawing frames, speeders, etc. They should always be of a soft, pliable nature, so that when being drawn on to the rolls they will give nicely. Great attention should also be paid to the piecings of both leathers and cloths. They ought to be so well made that it is impossible, by the touch, to discover them. If this is neglected, the yarn or roving is sure to be cut at each revolution of the roller; and when it is found to be cut about every three inches, it is sure to be the fault of bad piecings in the rollers. All the extra attention paid in

this department is sure to be repaid by the prevention of bad spinning.

The various imperfections in the top rollers, brought about by their being allowed to work too long before being changed, cause a great deal of bad work. When the rollers are fluted or have corrugations in the direction of their length, similar to those on the bottom rollers, they cause ends to be broken, and, if not taken out, much bad work and spinning are produced. Again, when the top rolls become "channelled," or have a continuous groove on their circumference by wearing too long, they are unable to "grip" the fibres of the thread properly, when by the movement of the traverse they come into the depression, and are thus prevented from drawing them in a regular and even manner; and as a result they produce a soft, uneven, and weak thread or rove. If the ends of the rolls are not finished off smooth, breakages and consequent bad spinning and uneven yarn is the result. Further, if the leathers or cloths on both ends or bosses of the roller (if fast bossed rolls) are not of the same thickness, they will cause one boss to have a greater diameter than the other; and since their motion is acquired entirely by contact with the bottom roller, there will be an amount of abrasion in one of the bosses which will give the yarn a raw, cloudy appearance, and cause cut, soft, and weak yarn to be produced. The remedies for these objectionable features are care, attention, and an intelligent and systematic inspection of all the rollers, and the removal of those in which any of these faults are found.

CHAPTER IV.

When the rolls are too dry they cause a coarser thread to be made. A great amount of indifference is often shown in respect to the back and middle top rollers, and some people seem to think that it is only about time to take them

out when the top finish of the leather is worn out, and to any one of an observant character this would be a serious omission; and it invariably produces a lot of bad spinning. These rolls ought to be taken out directly if they show any of the above defects. When the top rolls are dirty, or waste (roller laps) is collected, this takes the weight off one boss and causes weak yarn and bad spinning. The same thing occurs when the bottom rolls get into this condition; and when the waste is allowed to accumulate on the working part of the back steel roller, it increases its diameter at that part, and causes the yarn or rove to be made much coarser than it ought to be. The evident remedy for this is the thorough cleanliness of this part of the machines. When the bottom rolls have their working surfaces cut or indented, they cut and weaken the thread when in its traverse it passes over this part. And when their flutes or corrugations are worn too much, the top rollers have a greater liability to slip, since their motion is obtained only by friction, and this liability is still further increased when they require oiling or are dirty. The thread guides of the roller-traverse motion also require to be kept clean and not allowed to become too much worn, or they will cause breakage of ends stretching, and bad spinning. It is also very desirable that there should be a good motion attached to the frames and mules — one that is quick on the change and slow traveling, or "channelled" top rolls will be made and their consequent evils. The motion should also be set to the centre of the rollers, so that there will be no running out at ends, which is responsible for much bad spinning.

When the bottom rolls get crooked or strained from any cause, they jump when working, and for a number of ends cause stretched and weak yarn. When the gears driving the rolls are set too deep or have their teeth worn, or when any of the wheels are loose on the roller ends or on their respective studs, cut yarn will be made, which will be gen-

eral for the whole length of the frame, and may thus be distinguished from that caused by imperfect top rollers, which is only local in its effect, affecting the ends on those particular rollers only. The rollers must be properly set for the length of stock working, or weak yarn, much waste, and bad spinning will be made. The draughts should be well balanced, not too much between any one pair of rollers, always depending on the total draft, which should never be too great in any one machine.

The "cap nebs" must be securely fastened and in their proper positions, and so fixed as not to bind the ends of the roller. No two rollers must be in contact, and all rollers and their bearings and working parts perfectly clean, well oiled, and easy running, otherwise bad spinning will result; and these things can only be kept right by system, intelligence, and close attention to duty on the part of everybody concerned. The top and under clearers must be kept clean and well covered or they will allow the waste to be incorporated into the yarn, which if it occurs in the speeders will bring bad work afterwards in every process. Both the top and bottom rollers must be well and regularly oiled, picked, and cleaned, or bad spinning will result. The rollers should never be picked when running, for this practice causes cut, irregular yarn and bad spinning. When the saddles are set on the top rolls the wrong way, it causes the most weight to be put on the wrong roll. When they are worn they place too much of a surface on the rolls and retard their movement to some extent, and thus cause an irregularly drawn thread to be made. The weights should always be put on the right place, not one on one part and another on another position, on different levers.

The temperature of the rooms in a cotton mill should be an elevated one, especially for fine work, and in the spinning room, for several reasons. First, when the temperature of the spinning room is too low, a peculiar wax,

generally known as "cotton wax," which is associated with the outer surface of the fibre, becomes stiff, and renders the fibres more brittle, and an abnormal breakage of ends is the result. Second, it is a well-known fact that in order to obtain the best spinning, or even good spinning, the atmosphere of the room must be a moist one; and scientists tell us that the hygrometric condition of any atmosphere is directly affected by its temperature, and it is not the absolute quantity of moisture in the air, so much as its relative humidity, that affects the spinning; that is to say, it is the ratio of moisture or vapor actually present, to the amount which is capable of existing in the atmosphere at any given temperature.

The higher the temperature the greater the quantity of water which may exist in vapor in the atmosphere, and the rooms should be kept at about 80° F. of temperature, and nearly at saturation,as measured by the form of hygrometer known as the dry and wet bulb thermometers; then you will get just about as good spinning as you can, so far as the atmospheric conditions of your rooms go. Third, it is very generally known that when the room is in a dry state, the "natural moisture" of the fibre, or its water of hydration, escapes and is vaporized, and this naturally causes bad spinning. Again, when the room is in this condition, the electricity generated in the fibre by the friction to which it is subjected in the drawing process, is unable to escape and become latent, but remains in an unneutralized and active state, causing the fibres to have an electrical repulsion for each other, and their ends to fly off, and causes a soft, oozy thread to be made, and much bad spinning, since dry air is an almost absolute non-conductor of electricity; at any rate it is the worst known, and moist air is a fairly good conductor, and the damper the air, the better conductor it is. So that it will be readily seen from these considerations that a warm, moist atmosphere is essential to good spinning.

CHAPTER V.

In considering the means or appliances for putting the twist in the thread, the following causes and remedies are equally applicable to both ring and mule spinning: The cylinders are sometimes out of line, and consequently binding in their bearings, making the rim band in the case of the mule, and the belt in the ring frame, to slip until it is abnormally tight, thus putting in less than the proper amount of twist, and causing a soft thread and bad spinning to be made. The same thing occurs when the cylinder bearings want lubricating and cleaning. These faults may be remedied by a close observation and regular examination of both the machines themselves and the work made from them, which will be weak, inelastic, and soft, and by having frequent and fixed times for these things to be done.

The rim band, belt, or whatever transmits motion from the main shaft of the machine to the cylinder, must be kept tight, and in a good, flexible condition, so that it will not slip, but perform its work properly. Slack spindle bands cause soft yarn — from lack of twist — and bad spinning; these may be prevented by having the bands tied tightly when put on, and the right kind of knot made, a "reef" knot being the best, since it will not slip.

When soft cops are found, the help should put on a new band, or report it at once to the person responsible for doing so. Soft yarn is made by the spindles not being perfectly free and easy, caused by their being either tight or binding in the bolster or bearings, want of oil or cleaning, all these impeding their revolution and making bad spinning. Nothing can remedy these evils but strict supervision, order, and frequent and thorough oiling and cleaning. Long ends should never be left on the spindle

bands when tying, since these are apt to become entangled with the adjacent spindles, and cause broken ends and bad spinning.

On old mules the grooves of the rim pulleys are sometimes worn, and a ridge or shoulder formed on them, which prevents the band from getting down to its proper place in the groove. When this is the case, it cannot bite or grip as it should do, even when the band is sufficiently tight, thus causing soft yarn and bad spinning; when this feature is suspected, an occasional examination and the removal of those that are found to have these ridges on them will suffice to remedy this. This naturally applies to the pulley on the cylinder shaft as well as to the rim pulley. Carelessness in piecing broken ends is also a prolific cause of bad work, especially in the after processes.

When an end is pieced up with the thumb it is not properly twisted, but just hangs together, as it were, with sufficient strength to wind on to the bobbin, but is almost sure to break during spooling; and when we consider what a large number of ends are pieced in this way in a mill in a day's time, the extent of the mischief done is readily apparent. To remedy this, all the help that are found to be piecing up in this way must be instructed and taught how to change their method to that of doing it by the first and second fingers, for when this is done most of the pieced ends will carry through all reasonable strain afterwards. While dealing with the piecing of broken ends there are two things to be observed peculiar to mule spinning. The first is the raising of the cop on the spindle, when it has been running for some little time with the end down; if this is neglected it will cause "nick cops" to be made, and these are the cause of much trouble and bad work. The second point is that when the carriage has come out some distance from the roller beam some spinners will continue to piece up just as long as they can reach to do so, and to enable them to do this, they lift up the yarn off the spindle

with one hand and piece up with the other; if they did not do so the end would not attach itself to the rollers, but would catch on to the under clearer. Now this yarn that they have lifted off the spindle collects on its point and runs into snarls, and every spinner knows that these must be strictly guarded against; therefore any person seen to follow this practice ought to be told to discontinue it at once, and have the reason for doing so pointed out to him, and none but the veriest tyro would fail to see it.

It is, of course, of paramount importance in relation to good spinning that the proper amount of twist is put into the thread; and it must be remembered that if an overseer adheres rigidly to the rule for obtaining the twist, he will often find his room at sixes and sevens, for as I have previously observed in speaking of the speeders, the rule is all very well for obtaining the approximate number of turns per inch, and will answer satisfactorily when cotton of the right length of staple is used for the counts being spun, but the amount of twist must always be governed by circumstances, long cottons being spun with less, and short with greater than the standard, and to obtain the best results we must work accordingly, and if we do not the result will invariably be bad spinning.

We will now proceed to consider the causes and remedies for bad spinning that are applicable to ring spinning frames only, and we will commence with the traveler. In the first place it must always be remembered that the force exerted by the traveler is always greatest immediately after doffing, and the numbers to be used must be such as to just nicely carry the thread at that stage, and neither too heavy nor too light. Other considerations to be taken into account in determining the weight of the traveler to be used, and which if neglected will cause bad spinning, are counts being spun, and the length and strength of the stock being used; for it follows that the finer the counts the lighter the traveler, and *vice versa*, and,

as I have previously observed, the shorter and weaker the stock being used, the less elastic, strong and solid will be the thread, rove, or sliver, all through, and consequently not able to stand the same strain. When determining the weight of traveler to use for any particular class of work, our conclusions are often completely nullified by an unreasonable amount of uneven roving, that is as regards its hank, and this is one of the evils of uneven roving that I have not yet pointed out. It is a well-known fact that it is impossible to keep the roving exactly the right hank, and considerable (often too much) allowance is often made to the carder on this head; but when it varies all the way from one quarter to three quarters of a hank on each side of the the correct numbers, the task of the frame spinner overlooker is about to be a difficult one in getting at the right sort of traveler to use, for it will not answer to have many different numbers of them put indiscriminately on any frame. Say, for instance, that you are spinning 32s from a 4 hank having a draught of 8, and some bobbins are ¾ hank heavy and others ¾ hank light, then we shall have on some spindles 26s being spun, on others 32s, and from the light bobbins 38s, a difference of 12 hanks — a very serious difference indeed.

CHAPTER VI.

Dirty travelers are also a frequent cause of bad spinning, and the remedy for this is to have a good traveler cleaner. Some men oil the rings occasionally to assist the travelers, but I maintain that in well made and finished rings and travelers this is altogether unnecessary and does more harm than good, in making the loose waste floating about in the atmosphere collect more readily on the traveler, increasing its weight and breaking ends. Neglect in oiling spindles, besides causing the evils I have already pointed out, makes the yarn irregular or "bunchy," as it is often termed. The adjustment of the rings, spindles, and guide

wires, with regard to their relative positions, must be attended to or bad spinning will result, for if they are not all concentric they cannot perform their respective functions in a proper manner. The absence of a good "anti-ballooning" arrangement will cause many broken ends, when the speed of the spindle exceeds a given rate, for the centrifugal force generated by the rapid revolution of the spindle causes the threads to bulge outwards from their vertical position and form the figure of an inverted balloon, hence the term; this makes the ends to lash together and break each other; a heavier traveler will partially prevent the fault, but the consumption of power will be increased. Accumulations of dirt or waste and lack of oil on the lifting rods will cause them to stick and sometimes throw them out of position, making bad and irregular yarn; these faults may be removed by regular oiling and cleaning of the rods, and may be to a great extent prevented by having the rods protected with a sleeve. Warped and out-of-true bobbins will cause unnecessary trouble and bad work, and when cracked at the top the threads will catch and be broken, and any false economy in the matter of bobbins should be strictly guarded against, and all those which are found in this condition ought to be at once rejected.

We will now proceed to consider the bad spinning to be found in mules, and endeavor to point out where the faults are to be found, their remedies and prevention. The carriage must be in a parallel line with the rolls and beam, and the drawing-out and taking-in bands tight, and all as near as possible at the same tension, or some portions of the carriage will be either stretching the yarn or running it into snarls. The scrolls must all be so arranged on their respective shafts as to start the carriage and stop it both on its outward and inward run in an easy manner and without any sudden jerk or bang, else the yarn will be strained and weakened, have its elasticity destroyed at certain points, and ends be broken. The first of these

evils may be prevented by frequent examinations and measurements, and the tightening up of any band that may require it; the second may be altered by putting the scrolls forward or backward on their shafts as they may pluck, or bang, according to which end of the traverse this occurs. Where carriage floor stops are used they must all be kept in a parallel line and in their proper position, so that they may prevent all vibration when the carriage is brought to rest, on the termination of either its outward or inward run. The "drag" must be so adjusted as to keep all the ends at the proper tension when the carriage is coming out; if this is not attended to, the ends will be either stretched, or run into snarls, the former when the drag is too great and the latter when it is not sufficient, and in either case bad work will be made. Stretched yarn is sometimes made by having the "nut" on the quadrant too near the base, and thus turning the spindles too rapidly in proportion to the diameter attained by the cop; and the peg actuating the pulley which moves (through its band) the quadrant nut outwards must be arranged so as to do so at the proper time and not to move it either too much or too little at any one time, for if it is moved too much the fault will be found to be "snarly" yarn.

Snarls are sometimes made by the carriage slipping back a little after the holding-out catch has taken hold, owing to the catch being in the wrong position, too far in, *i e.*, too near the roller beam. When this is observed the catch must be set a little further back, just so that it will drop on to the stud, and hold the carriage exactly in the position in which it stops, until the necessary changes are made. The cam shaft must work quite free and easy, and its cams must be so arranged that each change will take place at the proper time, otherwise bad spinning will result. When the rollers stop too soon the result will be cut yarn, and when it is caused by this fault, it may be distinguished from that made by bad or faulty top rolls, by

its being general, *i. e.*, affecting the whole length of the machine, while the latter is only local in its effect, affecting only the threads on that particular roller. When the rolls start too soon, snarls are made, owing to the carriage not being able to take up the slack thus given out, and ends are broken through, the yarn being in a very weak condition just at that time, it not having its proper twist in it, and when they start too late they cause the yarn to be cut. To remedy this, put the attachment for gearing the roller catch box in its proper position, relative to the stopping and starting of the carriage. For spinning the finer counts of yarn, the spinning may be considerably improved by putting on the "bell wheel," or some other arrangement for holding out the carriage until the spindles have made the necessary number of revolutions for putting in the twist required for the counts being spun, and when this arrangement is fixed to the cylinder shaft it will almost entirely do away with soft yarn from slack rim bands.

CHAPTER VII.

The "bevel," or amount of inclination of the spindles, is another thing that must be noted in order to produce the best results, for when they have either too little or too much, it will cause unnecessary trouble to the spinners; and it will not be perhaps out of place to give the proper amount of bevel for the benefit of those who are seeking information. A sixteen-inch spindle, when on medium numbers, should have four inches of bevel, and other lengths of spindle should have it in the same proportion according to their length. When the spindles are arranged by this rule they will be found to work satisfactorily.

The fallers next demand our attention, and here I would warn the young spinner that a great deal of bad spinning is caused by their misarrangement, careless handling, and neglect. In the first place, then, the fallers must be

brought down upon the yarn gently, and after the winding faller has come in contact with the yarn, from its position of some two or three inches above it, it must just move with sufficient velocity to keep the yarn tight, and neither cut it by moving too fast nor allow snarls to be formed through its moving too slow. A good backing-off chain tightening motion will considerably assist in forming a good, solid, well-built cop, and eradicate many of the faults caused by slack winding, thus improving the spinning. When the backing-off chain has been adjusted to the proper length for backing off nicely at the commencement of a set of cops, it is desirable to gradually shorten it as the cop increases in length, until at the finish of the cop the chain is almost tight, and a good motion for performing this operation will so manipulate the chain as to correspond at every stage with the exact requirements of the case. Next to winding the yarn properly on the cop, this is the most essential condition in making a good cop. Again, the lever for putting the fallers and winding arrangement out of gear must be set so as to neither leave the yarn in snarls when the carraige is at the roller beam, nor cut it; and a judicious arrangement of this lever will leave the yarn just at the proper tension for the production of good work. The weight of the faller wires (counter faller) must be of the right amount so as to wind the yarn neither too tight nor too slack; it must also be equally distributed, or bad spinning will result from having cut or slack yarn, as the case may be. When the faller wires, especially the winding fallers, are not straight, they will cause the cops to take up different positions on the spindles, and when the tapered form of the spindle is taken into consideration the result is evident, for on different spindles on the same mule the yarn is being wound on to different diameters, thus causing tight and slack winding and their attendant evils — cut yarn, much waste, and bad spinning. The remedy for this fault is to have the wires straightened immediately they are found to be out of line.

The faller wires, being worn at the points at which they come in contact with the yarn, will break down many of the threads and cause bad spinning. When wires are found to be in this condition they should be immediately replaced with new ones. Arrange the rise of your faller according to the diameter of your cop, and have on the right builder wheel or you will have bad spinning. The quadrant must be set in its proper position or the winding on will invariably prove unsatisfactory; and the proper position for the quadrant is, when the carriage is at the outer end of its stretch, the quadrant arm should stand twelve degrees outwards from the vertical, and during the run in of the carriage it should turn inwards through an angle of ninety degrees. In connection with this, I would just say a word or two on the necessity of a good nosing motion. In the construction of the simple quadrant for winding on the yarn, the unequal diameter or tapered form of the spindle was not taken into account, but was constructed to form a cop on a spindle equal in its dimensions from the bottom to the top, and when the winding is arranged correctly for the diameter of the spindle.

CHAPTER VIII.

At the start of a set of cops, there is a constantly increasing departure from this point during the building, and as the finish of the set is approached, the cop noses get entangled, or "halched," which causes a great amount of waste in subsequent processes, and trouble to the spinner just before doffing; and at this time he wants to get all his work straight, and ends pieced up for this operation. The ordinary "nose peg," which deflects the winding chain, thus accelerating the speed of the spindles at the time the yarn is being wound on the apex, or nose of the cop, is a slight improvement, but is far from entirely obviating the fault, and the "nose peg bracket," though a slight improve-

ment to the above, is far from perfect. What is required is a motion of intermittent action that will accelerate the speed of the spindles in a ratio directly equal to the decrease in diameter, and the application of such a motion as this (and there are several such) will amply repay the additional outlay in improved spinning and less waste.

When a soft lot of cotton is being used, unless well twisted, and if too much of a drag is put on the yarn, it will break very often, and make bad spinning and snicked cops. The cops ought always to be made of the proper shape, well copped and firm. When they are allowed to run too full on the spindles, they become entangled at the apex and slack wound. They must be raised to their proper positions on the spindles when the ends have been down too long, otherwise snicks will be made in them. When the tubes are used, they must all be put on to their proper places; if this is not done, and they are left some up and others down, differential winding, with its attendant evils, will be the result; the cop bottoms must be well starched, when tubes are not used, at the fifth or sixth draw from the commencement, having been just previously "whipped," *i. e.*, the yarn run under two or three times to strengthen the aperture at the base, else much waste will be made in the process of weaving by "stabbing" them, owing to the aperture having become closed; and they will often adhere somewhat to the spindles, and many of them become ravelled during doffing. All the catches and springs must be in good working order, or they will fail to act at the proper time and cause snarls or cut yarn to be made, and sometimes break down all the ends. The weights on the top rolls, touching the carriage when it is at the roller beam, will cause soft places to be made in the yarn, owing to the weight being taken off the roll just at that time. To remedy this, they should be examined frequently and kept clear.

When an end breaks, it will sometimes be twisted in with

the adjacent one, and if this is not unwound very bad work is allowed to pass. Just before I conclude, it will perhaps interest some young spinner if I point out why snarls, or kinks, as they are sometimes called, are such an objectionable feature. Besides the trouble these give in weaving, owing to their shape, they also affect the strength of the thread for some distance in their immediate vicinity, for the "twist" in the fibres has a tendency to run together into these snarls, leaving the other portions comparatively without; and that portion of the thread being no longer held together by twist, it has very little coherence when subjected to even the slightest strain; therefore, from this it follows that they are apt to break under the strain to which they are subjected in winding on.

In conclusion, I would say that although some may perhaps assert that some parts of this essay are a little too abstract and theoretical, still it cannot be doubted that a knowledge of the elements of the theory is of very considerable value to those who are mainly concerned with practical results; and I have tried to put these remarks in such a practical manner as will be readily understood by those deserving young men who are striving to climb a little higher up the ladder of success.

Technical education is sadly behind in this country in the subject of cotton manufacture; and shortly we in America shall awake, as did our cousins across the water a few years ago, to its importance. Always remember that everything must be done systematically. Oil and clean at regular intervals, have every part of your department, whether you are a workman or an overlooker, doing all that it was intended to do, and have nothing stopped. Take as your precepts (and act up to them) "Perseverance conquers all things," "Attend to details," and "The end of all government is order."

CHAPTER IX.

There remains now one branch of the cotton spinning industry for our consideration, which does not come under the head of ordinary numbers in spinning. I refer to the "Derby doubler," "ribbon lap machine," and the "comber." And there are many points which must be carefully attended to, or bad spinning will result.

In the Derby doubler, and ribbon lap machine, the remarks relative to drawing rollers, top flats, etc., made in connection with the flier frames and spinning machines, are equally applicable, as also are they to the "draw box" of the combing machine. Then to consider each of these machines separately, so far as those faults peculiar to themselves, which will cause bad spinning, are concerned.

In the Derby doubler it is of importance — as in the case of the drawing frame — that the stop motions be kept in good condition, and that they be quick in their action. The bobbins must fit accurately between their flanges, or soft laps will be made that will cause a large amount of single in the lap machine, and the evil results of "single" are never entirely obliterated in any subsequent operation, although they may be greatly diminished. In the ribbon lap machine this is also of equal importance; further, this machine requires an extra amount of care in its working, since there are no automatic stop motions connected to the front of the machine, and on the failure of one of the ends it will continue to run until noticed by the attendant, and bad work is sure to result.

When too much weight is put upon the calender rollers, the laps will "lick" behind the comber when being unrolled, and cause single and double to be passed on. The obvious remedy for this is to reduce the weight on the end of the calender roller lever. The curved plates

over which the sliver passes must be free from any roughness, otherwise the sheet will catch and form uneven work; if any are found to be thus, they should be taken off and have their surfaces perfectly finished by burnishing. In the comber machine there are many things which will affect the spinning to a very great extent, if, through either carelessness or ignorance, they be not attended to.

CHAPTER X.

Now to consider those points which have their effect on the spinning: It must be remembered that in very fine spinning, when these machines are generally used, small items that would be hardly noticed in the coarser numbers have a much more serious effect, and greater attention must be given to them.

The first subject, then, for consideration, in so far as it will affect the spinning, is the setting of the "comber." The cushion plate must be set "very equally" to the fluted segment all the way across, and care must be taken in pressing down the nipper knife on to the plate during this operation, that an equal pressure is applied all the time that it is being tested by the gauge.

If this is not very carefully done it will be found to so affect the "detaching" function of the machine, and also its combing, as to render the sliver very weak. Sometimes, in fact, it will be found so much so as to barely have strength to carry on the table to the draw box of the comber, and where a sliver of such weakness is produced, it is evident that the resultant yarn will be weak, and broken ends and irregularities will be found, not only in the yarn but also in all the following processes.

Then the condition of the leather composition or rubber, as the case may be, of the cushion plate is also a matter of importance in the production of good work. For if it is not perfectly level, so as to ensure a good firm grip or

" nip " upon the material as it is being combed, an irregular and cloudy sliver will result, and the effect upon the spinning will be similar to that previously noted. Of course the remedies for these defects are care and experience in setting, and careful examination of the covering of the cushion plates of every machine.

The parallelism of the detaching roller and feed roller to each other also requires notice, for if they are not parallel to each other at both ends of the frame, one end may be performing its duties properly, and the other neither making cloudy, unequal work nor breaking the fibres. Their relative positions ought always to be altered by moving the feed roller up or down as may be necessary, and the fault thus remedied.

The top leather detaching rollers must always be carefully attended to, since, if they are not in excellent condition, good work cannot be expected. They must be very equally covered, and a good varnish applied to them. If they are at all unequal or lack varnish, a cloudy irregularity will be observable in the web as it is delivered by these rolls, and this, of course, means an appreciable effect on the spinning where the finest numbers are being spun.

These defects can be obviated by frequent and systematic examination of the leather detaching rollers, and by the exercise of great care in the roller shop when covering these rollers. In fact, in my opinion, these rollers are the most important in the whole range of fine spinning, and any amount of care and attention bestowed upon them is sure to be amply repaid in the quality of yarn produced. The " oscillating top brass detaching roller " must be set so as to be just " flute " for " flute " to the bottom iron detaching roller. By this I mean that their corrugations must be set like the teeth of two wheels geared into each other, for if they are at all crossed, or " dog-legged," they will cut the fibres at each revolution, and this will obviously weaken the product in every operation so much that

the spinning will be seriously affected, and many broken ends, much waste and single will be made. It will be easily observable on feeling these rollers whether they are in the proper position or not, since their cross movement is readily felt if the machine be stopped and the roller be worked gently backward and forward. If they are out of position, they can be quickly altered by set screws at each side of the roll.

A few general observations are in order upon the working of these complicated machines, and the results found by their neglect, which, although perhaps singly undetectable in the operation of spinning, would in the aggregate cause very bad work to be made. In the first place, then, cleanliness is of the utmost importance in these machines. Small pieces of waste must never be allowed to accumulate in the corners of the guide tins; nor must the top flat on the detaching roller be allowed to become too dirty, for this would cause the end to break, and since there are not stop motions to these machines, the prevention of single is dependent on the care — too often absent — of the attendant. Further, the cylinders, brushes, and doffers must be kept well picked, the needles must be in good condition, and set at equal heights in the brasses of the cylinder, for if this is not correctly done it is an impossibility to set the machine with anything approaching accuracy. The needles of the top comb must be especially in good order all the time, for if two or more contiguous needles are missing, the web will have a "stringy" appearance, owing to imperfect combing. The studs working in the combs must always be in good order, not having flat sides nor their pins worn, since all these affect the product, and as I said above, although, individually, these points would be hardly observable in their effect on the spinning, yet, taken together, their effect would be very considerable indeed.

JOHN B. CUDLIP.

JOHN B. CUDLIP,

OF FALL RIVER, MASS.

John B. Cudlip was born on March 11, 1867. On leaving school at the age of sixteen, he entered the office of the St. John Cotton Co., St. John, N. B. A portion of his duties consisted of taking in any mail that had come to the office for the hands, so, from being frequently through the mill, he soon became familiar with, at least, the appearances of the various machines. As he was fond of mechanics, the machines were extremely interesting, and he desired to know all their ins and outs.

One day, after he had been in the office several months, the secretary of the company asked him why he did not go into the mill and learn the business of cotton manufacturing from cellar to attic, so to speak. He pointed out the various advantages of his pursuing such a course, and recommended the matter to his serious consideration. After thinking over the matter and looking at it in various lights, he finally decided to adopt Mr. Kitchum's suggestion, and, a man leaving the picking room shortly after, he took his place running a picker. From the picking room he followed the cotton through the various departments until it comes out the finished product. Upon the St. John Cotton Co. going into liquidation he entered the employ of William Parks & Sons, Ltd., where he remained some four years, working in various capacities in different departments.

On leaving them he went to work for Mr. A. A. Brigham, of Boston, importer of machinery. He left him to take charge of the spinning, etc., of the Colchester Mills, Winooski, Vt., which position he resigned to accept the superintendency of the Powhatan (Maryland) Mills. He resigned that position and re-entered the employ of Mr. Brigham.

PRIZE ESSAY ON SPINNING,

No. 12.

BY JOHN B. CUDLIP.

CHAPTER I.

In treating of the various causes of bad work and their remedies in the process of spinning, I will divide the subject into two sections, one of which relates to mule and the other to ring spinning.

In order to more plainly enumerate the various causes of bad work, I will divide these remarks into sub-sections on: Bad work caused by rollers; bad work caused by the spindles and carriages; bad work caused by the copping and winding mechanism, and bad work arising from various other causes.

Bad work caused by the rollers: How frequently we see very uneven, cloudy yarn produced from well-carded, even roving. This fact arises, as a general thing, from several causes. One frequent cause of it is that too great a draught is being used for the stock of which the roving is made. If the distance between the middle and back rolls is too great, uneven yarn is the result, and if the draught between middle and back rolls is too great for the quality and twist of the roving, uneven yarn results. Right here, in the matter of middle and back draught, is where a great deal of roving is spoiled. Just because a mule frame has a certain draught between the middle and back rollers when it comes from the shop, some people will let it run that way, regardless of the twist, stock, or size of the hank roving. When the roving is soft and

the stock tender, the middle draught should be very, very slight, merely sufficient to keep the roving tight. With a hard-twisted roving or that made from long staple, strong cotton, the draught can be increased with benefit to the yarn, as it partly opens the roving and makes it draw more evenly between the middle and front rollers. On 16s hosiery yarn, I have produced a much better yarn than had been spun from the same hank roving and stock, merely by changing the middle draught. I generally set the front and middle rolls one sixteenth of an inch further apart, from bite to bite, than the average length of the staple being drawn ; it is better to have the rollers a little too close than too far apart, as in the former case it soon shows itself by "twirling," while in the latter case, a man, even if he notices that the yarn is not right, is too apt to let it go, and will, in all probability, say, if anything is said to him about the look of his yarn, "Well, yes, it does look a little uneven, but the card room is to blame for that." The coarser the hank roving, the further apart the rollers should be set. The amount of draught also governs the distance. The front top rolls should be set so as to bring their centres just a little further out than that of the steel rolls. If the top roll is set directly above the steel one, it is very apt, especially when the cop neb is worn, to fall back when the steel roll stops, and when the steel roll starts again the top roll will move forward until it strikes the front side of the neb, and thus produces cut yarn.

Bent steel rolls make irregular yarn. The only cure is to take them out and straighten them. When the flutes of the rolls get worn very smooth, they are very liable to produce an unevenly drawn yarn, unless an extra amount of weight is put on the top rolls. Refluting of the rolls is the only real remedy for this, but, as a rule, when the rollers get so worn, it will be found far better to throw the machine out and put in a new one. The weights are very liable to get in the wrong nicks of the levers, and the levers get set-

ting at different angles. The latter is caused generally by the saddles getting mixed during scouring. These points require watching, as they tend to make bad work and bad spinning. Have the clearers kept in proper condition, the top ones smoothly lapped, as when they are not, lumps are very liable to drop down between the rollers and make bad work. Keep the bottom clearers well covered with flannel, so that when an end breaks it will be sure to catch on the clearer and not fly over on the next end.

The squares of the rollers being much worn are a fertile source of cut work, especially when the back and middle rollers are driven from the far end of the front steel roller. The gears need watching pretty closely; sometimes a tooth gets broken out and they run along for a time, making uneven yarn at every revolution, and sometimes some of the teeth get so filled up with waste as to force the gear out of place, causing it to miss a tooth or so, occasionally making cut yarn. The steady pins are sometimes too small for the holes in the gears, causing a back lash at every stretch, which causes cut yarn. See that the saddles sit squarely on the necks of the rolls and that the stirrups do not rub on the steel rolls. The axes of the leather rolls should coincide with those of the steel rolls, because when one end of the leather roll is further out than the other, uneven yarn results. Both bosses of the leather rolls should be of the same diameter. If one side is larger than the other, it lifts the smaller side up from the steel roll, making cut, uneven yarn. When using shell front rolls, by looking after the spinners and insisting that they use care when sizing their rolls, no trouble will be experienced from difference in the size of the bosses, but when the solid front roll is used, the only thing to do when the bosses are found to be of different diameters is to throw the rollers out. It is a great folly to run a new roller when the piecing is bad. It is often done "because I don't want to use many rolls;" but running a poor piecing is very bad economy, because

it will make uneven work as long as it runs, and the same remark applies to loose cots.

Lack of oil on the roller bearings is a frequent cause of bad work. See that the spinners keep the rolls well picked and oiled, but look out that too much oil is not put on at one time, as the moment there is any superfluity it will run on to the leather and spoil it. I have found oil and tallow mixed to be the best thing to lubricate rolls with. The tallow gives the oil body and prevents it evaporating so quickly. In mixing the tallow with the oil, care should be taken not to get too much in, for if you do, it will stick everything up. Experience is the only teacher of what quantity of tallow the oil will carry. Sometimes the steel rolls get badly cut up by the spinners carelessly using their hooks in taking off roller laps; this means uneven yarn. It depends upon how badly the rollers are cut, whether they can be fixed in a measure even.

Bad work caused by the carriages and spindles: The carriage being out of square is very productive of cut and strained yarn. This is caused by one end striking the stops before the other. It is also very hard on the carriage when it is out of square, and tends to bind the tin cylinder; in extreme cases causing the cylinders to run so heavily that the rim band will slip some, causing slack twisted yarn. To keep the carriages as square as possible, have the band of a good quality and well stretched when put on, and see that the person who puts the band on or squares the carriage gets the bands of the right tension and not pulling against one another. If using chains instead of bands to work the carriage with, see that the teeth of the sprocket wheels on the back shaft are kept clear of waste, for sometimes it will get packed in so tightly that it causes the chain to slip a tooth or two. See that the slips are level and that there are no loose packings which will allow the slips to spring when the weight of the carriage comes at that point.

CHAPTER II.

When the back shaft is run too far over — by this I mean too far down on the inclines — the carriage, when the bands are on the incline, draws out slower than the speed of delivery of the rollers, thus causing slack yarn, and the castle head has to be set out so far in order to get the carriage to come on the catch, causing kinks. The boot leg knocking off too soon also produces kinks in the yarn. Tin cylinders running out of true, and dents in the cylinder, are productive of bad, slack-twisted yarn. If the bevel of the spindles is too great for the counts being spun, the yarn throws over the points of the spindles, causing snarls. Another cause of snarls being formed is the fact that sometimes the catch box of the cam slips, when the mule strikes out, thus delaying the throwing out of the roller catch box, which causes the roller to deliver too much yarn. The slipping of the catch box may arise from several causes; the teeth may be badly worn, there may not be enough spring on, or the speed may have fallen so much that the cam does not get over far enough to change the motions. This is the case when the pin that bears against the incline of the cam and forces the loose half out of gear is too long.

The friction cam that is applied to some of the new mules is a great improvement over the clutch arrangement. On the former, when the speed gets low, the cam is very liable not to make its full half revolution; thus the loose box is not forced clear of the tight one, causing it to "rake," which wears the teeth out and makes a very disagreeable noise. This is avoided on the friction cam, because it takes such a small movement to disengage the loose half. The cam shaft can be run at a much higher speed with the friction than the clutch, thus enabling the

change to be made in less time, increasing the production, and improving the quality of the work.

Sometimes the roller catch box will slip a tooth or two when the mule starts out; this is caused either by waste being in the teeth, the teeth being worn, not enough spring on the catch box lever, or want of oil on the loose half of the catch box; this slippage causes strained cut yarn. The drag wheel teeth or those of the back shaft wheel sometimes get worn or filled up with waste, causing the drag wheel to jump. This stops the carriage and throws in kinks; when the carriage starts out very keenly, the drag wheel is especially liable to jump. On one make of mules at least, the Taylor & Lang, the liability of the drag wheel jumping when the carriage starts out is done away with by putting an extra pressure on the drag wheel until the carriage gets well started.

Care should be taken to see that the spindles are all of the same bevel, as, if there is any difference, the yarn will show it. In getting the bevel of the spindles it is necessary to take into consideration the distance that the spindle is set below the steel roller, the number of yarn to be made, and the twist and stock, as each of these will affect the bevel. With too much bevel the spindle will throw the yarn into little pinhead kinks, while with too little bevel it strains the yarn. Bent spindles, spindles needing oil, waste or dirt getting in the collars or footsteps, or slack bands, all cause bad work. The oiling should be regularly attended to and the spindles and carriage cleaned at sufficiently frequent intervals to keep them clean. Get good spindle banding, and see that the spinners put them on right and tie good, firm, flat knots.

Bad work is caused by the copping and winding mechanisms. This is one of the places where a great deal of very often unsuspected bad work is made. Bad cops mean bad spinning, bad weaving, and bad dividends; because, with a badly constructed cop, it is impossible to avoid making too

large a percentage of waste. A well constructed cop is of an almost uniform hardness, the bottom, when the winding is properly attended to, showing no run under or slashed threads; where the bottom comes to the full thickness it should be clearly defined and at the same time show no ridge; the diameter of the full thickness should be uniform throughout its length; the chase should show no ridges or hollows, and the nose be firmly wound. The length of the chase should increase from the first stretch after doffing until the full thickness is reached; from there till the completion the chase should constantly grow shorter, for two reasons: First, because the cop is bound more firmly and better fitted to withstand hauling; and second, because it is possible to get more yarn on the cop. If a cop is not right, in looking for the cause or causes of it, in the first place see if the defect is due to the spinner having too much or too little strap on, or not enough nose peg working; if the scroll and back shafts are properly set; if the faller couplings are keyed up solid and allow no play, the fallers all set the same distance from the spindles, the sides bent to the same angle, the slips level and firmly packed, the carriage square and working easily, and as stiff as possible; see that the backing off is all right; that the quadrant is set right and has the right sized pinion on; that the hastening motion is being looked after by the spinner; that the bearer bowl is true and that there is no back lash on any of the studs or bearings.

In order to determine which of these things are at fault, if any, I will tell how I think they should be set. The scroll shaft should be set so as to draw the carriage firmly into the stops, so that there will be no jerk or dwell; the faller rods should first be set by a gauge at a uniform distance from the spindles; the sickles should be set at the required place. Have the winding faller set so as to bring the faller wire as close to the cop as possible, during winding, without rubbing. The closer it is set, the evener

and better the winding will be. If any of the slips give on account of the packing being loose, it will make rigid chases on the cops at that particular point, and in fact change the whole general shape of the cop.

In setting the quadrant, several things must be considered: the shape of the rail, size of the quadrant pinions, size of winding drum, and length of quadrant. Set the quadrant as far back as possible, for when it is set well back we get evener, steadier winding than when it is set too far forward. In the latter case the counter faller comes up too high when the mule starts to go in. If possible, — and it is possible if you know how to do it, — have the winding so that the counter faller will ride almost level during the whole inward run of the carriage. Whenever you see a faller "dancing," be sure that the cops on that mule are not right. On some makes of mules it is possible to go by the old rule. Set the qradrant straight up and down when the bearer bowl is in the high point of the rail; but this rule will only work sometimes. If the quadrant is driven by bands, see that they are tight enough. If there is any slack in them, irregular winding results. Sometimes the quadrant screw gets a little bent, which makes the strapping band slip and the winding get too tight. With quadrants driven by bands, finer setting can be obtained than when using the side shaft, and when using the side shaft, unless the person who squares up the carriage is careful, he will get the position of the quadrant changed, through the back shaft being turned over or back a little from some of the bands being tighter than the others.

CHAPTER III.

As soon as the quadrant bands get much worn, take them off and put new ones on. A quadrant band breaking often means a bad smash. See that the winding click takes hold promptly when the mule backs off. On some

makes of mules, the locking of the winding click is governed by the boot leg, but, in my opinion, as good and better results are obtained by the use of the old click and spring, especially on quick-running mules. When either the click or the click gear teeth are much worn, uneven winding results, as the click will sometimes jump a tooth or two. By using the split click gear, an old one can be removed and a new one put in its place in a very short time and with very little labor.

If the winding drum is binding so as not to take up all the slack of the winding chain while the carriage is coming out, very bad work results. Keep a few chain blocks on hand, and whenever you find one that has much play on the quadrant screw, take it off and put a new one on, for where there is any play, uneven winding and a severe strain on the whole winding mechanism takes place. See that all the set screws on the tin cylinder arbors are set up tight. When any of them get loose it causes bad backing off and winding. Have the mule start in easily, as a quick jerk is very severe on the winding mechanism and yarn. The swan neck should be nearly level wher it strikes the backing-off lever bowl. By setting it thus, smoother backing off is obtained. Have the backing-off chain sufficiently tight to make the faller follow the yarn easily down the spindle. With too slack a chain it is impossible to make a good firm nose. Most mules now have the automatic backing-off chain tighter. A mule will stand having the backing-off chain tighter towards the end of a set than when on the bottoms. On mules having the thumb-screw, to regulate the length of the backing off, a great many sets of fuzzy-nosed cops are made by the spinners neglecting to tighten the chain as the cop gets full. The hastening motion is also a great help toward making a good firm nose and keeping the kinks out of the yarn, especially on hard-twisted yarn. On one make of mule at least, the Taylor & Lang, the hastening motion is auto-

matic, being worked from a stud on the back plate. If the hastening motion is worked by a thumb-screw, see that the spinner looks after it.

The spinner putting on too much nose peg at one time is productive of bad work in the shape of strained yarn and bad noses on cops. The automatic nose peg, worked either by an independent gear or else from the shaper plates, is much the best, as by its use uniformity in the use of the nose peg can be secured. Have the bottom of the bearer, where it rests on the bearer, perfectly level, except just on the inner corner, where it should be a little rounded off in order to make the boot leg unlock more easily. Set the monkey tail so that the full benefit will be derived from its shape, and the fallers unlock sooner on the bottom of the cop than on the nose.

If, after looking over all these points, it is found that they are all right, then go to the rail and plates. But be careful about putting a file to either rail or plates. Both sides of the plates should be of the same height, so as to give the rail no chance to give about it. The back plate governs the relative length of the chase, while the front plate governs the shape of the cop more. The back plate should fall a great deal more steeply than the front plate in the portion over which the stud in the rail slides during the building of the bottom. This is to make the length of the chase constantly increase until the bottom is built; from the time that the bottom is built, the incline of the front plate should be steeper than that of the back one. This is to shorten the chase as the cop gets full.

The portion of the front plate that forms the cop bottom must be filed to suit the taste of the person. If the bottoms are desired to be more or less rounding, file that portion of the plate more or less hollow. From the point of the plate where the full thickness of the cop begins, it should be perfectly true, that is, should show a perfectly straight surface to the end of the plate. Most new mules

have the loose front incline on the rails. This is a great improvement over the old soled rail, as by its use the point of locking of the faller can be kept at the same relative point of the chase throughout the cop. The rail should be filed so that there will be a constant rise up to the high point. From the high point it should drop quite sharply for about two and a half inches. From there to a point about an inch beyond the stud that works in the rail slide, the rail should be level, but have a uniform dip towards the back plate. From the point beyond the stud the rail should begin to fall at a constantly increasing inclination until the inner end is reached. In filing the rail the very greatest care must be taken so that the bearer bowl will have a bearing the full width of the rail, and so that there is not the slightest hollow in its entire length. A few wrong strokes of the file cause hours of hard work very often before the proper shape can be regained.

If the plates and rail are right, and you wish to change the length of the bottom, you can set out the stop screw placed in the front plate. If the cop is too thin in the bottom, draw the back plate in. If it is desired to lengthen the bottom, draw the plates up further by setting the stop screw in. If you wish to alter the length of the chase on mules having a setting screw on the outer end of the rail, it is a very easy matter. The more you elevate the front of the rail, the longer chase you will obtain. On the old make of mules having no setting screw for this purpose, the only way is to file down the back plate. In defects of the cops, the rail is at fault for an uneven chase, that is, of course, when all the above-mentioned parts, such as winding, etc., are right, and the plates for bad shape, such as the cop being the right size in the middle and small at the shoulder and towards the nose. In closing the paragraph on copping I will say that different yarns require differently shaped cops. A weft cop is differently shaped from a twist cop, and a fine yarn requires a differently shaped

cop from coarse. It is very much easier to make a good-looking cop on fine yarn than on coarse, but the true test, if you wish to make it, is to take a mule, spinning medium numbers, say 40s, and put it on 6s or 7s, and then if the rail and plate are not exactly right, the cop will show it very plainly, while on the finer yarn it would be making an apparently good cop.

CHAPTER IV.

Bad work arising from various causes: In this section I will take up colored work among other things. In running colored work it will be found necessary on some colors, especially when the stock is a little "burnt" and tender, to humor the mules in every possible way. I always use a varnish on the front rolls when running colored work, for two reasons, one of which is that it is the greatest preventive of lapping that I know of, and the other reason is that by its use there will be a great many less rollers used and better spinning obtained. When drawing browns, navy blues, blacks, and other hard colors, if you put a roller in without varnishing you will notice that in a day or two the finished surface of the leather, for the width that the roving traverses, is cut off, and that the leather looks roughed up; with rollers in this condition it is impossible to get good spinning. The roving will not draw evenly, and when an end breaks, up it goes around the leather roll, making cut yarn on the other side of the boss; and we all know that when a spinner, or rather a careless spinner, gets a lap or two on a roller, especially when the work is running badly, he is more than likely to spoil the roll in picking the lap off. Have the backing off as easy as possible — no jerks — and look out that the mule does not start out from the beam very keenly; if it does, it is sure to snap down the ends.

On some makes of mules it is possible to set the driving

belt so that it cannot get on the tight pulley for its full width. On other mules it will be found necessary to slacken the driving belt so that it will not drive too keenly. The faller weight inclines are also a great help. Set them so that the full weight will come gradually on the yarn. If the stock is tender, you will also have to run it with very little drag in, and set the castle head out so that there will not be much jacking. When the roving is hard and "spews" through the front roll, put more middle draught in, but be careful not to get too much.

The bottoms of the skewers getting very blunt, waste getting around the bottom or top of the skewer, or the footsteps getting knocked or worn out, also cause bad work by stretching the roving. The roving guides getting partly stopped up with waste is also another cause of stretched roving. Bad piecings of the rovings should be watched for closely. Some boys are very hard to teach in this respect. They seem to take a positive delight in making hard, black, wet piecings with great long tails. The spinner's piecings should also be watched. Some men have a habit of letting lumpy piecings go so long as the end will stay up. I think that a good way to prevent bad piecings from the card room going through is to pay the back boys so much a hundred for all bad bobbins picked out, and then charge the frame tenters, whose marks are on the bobbins, for the amounts you pay the back boys. If you have not the automatic scavenger on, have the carriage and roller beams wiped off frequently enough to keep them clean, be it twice or ten times a day, for when waste is allowed to accumulate on either, a sudden draught is very liable to blow some of it on the yarn. Keep the ceilings, shafting, and pulleys, gas pipes and fixtures and sprinkler pipes, clean. When they are allowed to get dirty, small pieces of dirty waste are very liable to drop into the yarn and make bad places unless detected by the spinner. In oiling the bolsters, care should be

taken to keep the oil from getting on the cops. The scouring must be attended to if good work is to be produced. Scour frequently and thoroughly, and you will have your own reward. Have a system throughout the room, and remember that success in spinning or any department of the mill is only attained by attention to small matters and having a good system well carried out.

Ring spinning: The causes that I have pointed out under the head of rollers, in the section relating to mule spinning, also apply to the rollers of the ring spinning frames. Have the lifting rods run true and see that they work easily up and down. If a rod is worn, take it out and put in a new one. Worn lifting rods allow the rings to alter their position with regard to the concentricity of the spindles. This throws a severe strain on the yarn and causes bad work. When the lifting rods are not working freely, they will frequently cause rings or ridges to appear on the chase in a cop wind, or on a warp lift will make the thread wind over at the ends. The rail not being properly balanced will sometimes have a similar effect. Keep the rods free from waste and well oiled. By careful setting of the rings, so that the spindle will be exactly in the centre, the evil resulting from the spindle being out of centre may be avoided, thus producing a better quality of yarn. Go over them occasionally to see that the rings have not accidentally been moved. Set the pig-tail wires so that a plumb line dropped from the inner edge of the turn will strike the centre of the spindle. When the pig tail is not in its proper place it throws a strain on the yarn from the fact that it makes it bind on one side of the spindle, thus causing bad work. As soon as the thread cuts a groove in the pig tail take the wire out and put a new one in, because whenever a groove is cut and the yarn run through it, it tends to put extra friction on the yarn and keeps the twist from running up to the bite of the rollers.

When using separators see that they are kept free from

slugs or bunches of waste, which are liable to get on the yarn. The traveler cleaner should be set so as to keep the traveler as clean as possible, but in addition to the cleaner a traveler brush should be used several times a day. Set the brush so that the bristles will just touch the traveler. Do not let the travelers run too long, with the idea that it is economy, for it is the dearest thing to do. Watch the travelers closely and find out how long they will run well. Then make it a rule that once in so many weeks all the travelers on a frame shall be renewed. When the bobbins get worn so that they vibrate badly throw them out, as running them is productive of strained yarn and it is also very hard on the spindle. Have good banding and have it well put on. Soft twisted yarn means bad work in the spooling, slashing, and weaving, and also makes streaks in the cloth. Have all the ends twisted; allow no "dab" piecings, which are very productive of bad yarn on account of the lumps they make. Have all the parts of the machine oiled as frequently as necessary. This will depend upon the oil used, speed of the machines, and temperature of rooms.

When there is any arrangement for moistening the air of the rooms, the quality of the work will be greatly improved on dry days. This is especially so in spinning colored work or merino yarns. In a dry atmosphere a good deal of frictional electricity is generated, which makes it very difficult to handle the work with any degree of satisfaction. It also makes the yarn fuzzy and rough looking.

In the ring room, as in the mule room, it is attention to details that ensures success. Care and attention are the watchwords used in securing both quantity and quality.